SEP 7 192

LIBRARY
SEP 7 1921

VOL. LXXXIX. No. 2283. [All Rights Reserved.] AUGUST 26, 1921. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE SIXPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C.4. SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £1 1s. 8d. per annum.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOUCHAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos.: Central 8260 and 8261.

LITHOLITE INSULATORS, Ltd.
58—57, Hackney Grove, London, E. 8.
'Phone and Telegrams: Dalston, 592, London.
FIREPROOF AND OTHER GRADES.
ESTABLISHED 20 YEARS.

Birkby's "ELO"
For all purposes for which moulded insulation is required specify "ELO"—which is water, oil and heatproof.
FLEMING, BIRKBY & GOODALL, LTD., LIVERSEDGE, YORKSHIRE.

WRIGHT 'Phone: 499. Tel.: Motor.
A.C. and D.C. **MOTORS.**
WRIGHT MOTORS, Ltd., HALIFAX.

EVERY DESCRIPTION OF
SMALL TURNED PARTS and CASTINGS for ELECTRICAL ENGINEERS.
A. MORTON,
6, Tenby Street North, Birmingham.

BROOK
ONE, TWO and THREE-PHASE
MOTORS.
See Sup. 41.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors.
GREENLAND PLACE, CAMDEN TOWN, LONDON.

MICA & MICANITE
TAYLOR & PETTERS, LTD.,
40, Hatton Garden, London, E.C. 1.
'Phone: 4575 Central.
See page ii.

MOTORS. • DYNAMOS.
VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE,
Kingsway, London, W.C. 2.
'Phone: Gerrard 1945.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

ELECTRIC MOTOR REPAIRS.
ARMATURES REWOUND.
H. DUNN & SON,
Newington Causeway,
Tel.: Hop. 1167, LONDON. S.E. 1

"EMPIRE"
AUTOMATIC CONTROL
FOR
Pumps, Compressors, Machine Tools.
ELECTRIC CONTROL, LIMITED, GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement last week, p. vi.

CONNOLLY'S (BLACKLEY), LD.,
for
WIRES AND CABLES.
See Advertisement this week, p. iii.

WHITE
Electrical Instrument Co., Ltd.
2, 4 & 6, GLOUCESTER ST., CLERKENWELL, LONDON, E.C. 1.
Wire: Voltograph, London. 'Phone: City, 8660

ELECTRIC MOTORS.
One, Two and Three-Phase.
BRITTAIN'S ELECTRIC MOTOR Co.
(Late Langdon-Davies Electric Motor Co.),
110, Cannon Street, London, E.C. 4.

INSULATING
- - BEADS - -
Immediate Delivery.
HOLDER-HARRIDEN LTD., 35/37, Noble St., London, E.C.

The House on the Hill.
See Sup. 16.

Better than Rubber, Leather and Gutta-Percha.
BELTING.
DERMATINE
DERMATINE CO., Ltd.,
Neate St., London, S.E. 5

SHUNT REGULATORS.
MOTOR STARTERS and all classes of Resistance Work.
STAR DELTA SWITCHES.
THE SOLENOID REGULATOR CO.,
HIGHGATE SQUARE, CAMP HILL.
Telephone: Midland 582 BIRMINGHAM, Telegrams: Solenoid, Birmingham.

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

ALUMINIUM CANNOT RUST.
British Aluminium Co., Ltd., 109, Queen Victoria St., London

RAYNER & HEALD, LTD.,
DUKE STREET, DERBY.
TWO & THREE-PHASE MOTORS only.

FULLER'S UNITED ELECTRIC WORKS, LIMITED.
MANUFACTURERS OF
ACCUMULATORS BATTERIES
WIRES & CABLES CARBONS, &c.
WORKS: CHADWELL HEATH, ESSEX.
General Sales Offices:
IDDESLEIGH HOUSE, Caxton St., Westminster.
'Grams: Blocbat, Vic. London. 'Phone: Victoria 6963.

INGLEBY & CO.,
Old Lane, Beeston, LTD,
MOTORS LEEDS.
FOR DIRECT AND ALTERNATING CURRENT
Tel. 20275
Delivery from Stock up to 50 H.P.

Advertisement Index, see page xliv.

SWITCH ON EDISWAN

For any of the following Electrical Supplies:—

Accessories.
Accumulators.
Bells & Accessories.
Circuit Breakers.
Controllers.
Decorative Fixtures.
Decorative Glass Ware.
Dry Cells.
Dynamos.
Electric Fires and Radiators.
Fans and Ventilators.
Heating and Cooking Appliances.
Industrial Fittings.
Inert Cells.
Instruments—Indicators.
Instruments—Meters.
Ironclad Switch Gear.
Lamps—Royal Ediswan gas-filled & vacuum types.
Leclanche Cells.
"Little Glutton" Vacuum Cleaner.
Motors.
Oil Switches.
Telephones & Accessories.
Wires and Cables.

Mark the items in which you are interested and post this page to us, when we will gladly supply full information.

THE EDISON SWAN ELECTRIC CO., LTD.,
PONDERS END, MIDDLESEX.
London Showrooms:
123-5, Queen Victoria St., E.C. 4 & 71, Victoria St., S.W.1

THE
'SISSON'
Patent High-Speed Enclosed
SELF-LUBRICATING ENGINE.
For Direct Coupling to Dynamos, Pumps, Fans, Blowers, &c.

Full Particulars on Application to—
W. SISSON & Co., Ltd.,
ENGINEERS,
GLOUCESTER.
Tels. "Sisson, Gloucester." Tel.: No. 57.

MICA & MICANITE
INSULATORS FOR EVERY DESCRIPTION OF ELECTRICAL WORK.
Contractors for Air Board, War Office and Admiralty Requirements.
CUTTING AND GAUGING OUR SPECIALITY.
BEST QUALITY MICA ONLY.

'PHONE—4575 CENTRAL.
TELEGRAMS—"MICAYLOR, LONDON."
TAYLOR & PETTERS, LTD.,
40, HATTON GARDEN,
LONDON, E.C.1.
(The Oldest Established Mica House in the country.)
AND ALL BRITISH.

ARMSTRONG, STEVENS & SON, Ltd.,
WHITTALL STREET,
BIRMINGHAM.
PRICE LIST ON APPLICATION.

INSULATING MATERIALS - *Delivery from Stock*
SUPERFINE COTTON, LINEN & SILK TAPES,
DYNAMO TAPES, FIELD COIL WEBBING, CABLE TAPES,
ADHESIVE TAPE, TUBULAR SLEEVING, ARMATURE BINDING CORDS &c.
JOHN MACLENNAN & Co
115 NEWGATE STREET LONDON E.C.1.
Telephone: City 3115
And at GLASGOW

THE

ELECTRICAL REVIEW.

VOL. LXXXIX. AUGUST 26, 1921. No. 2,283.

ELECTRICAL REVIEW.

Vol. LXXXIX.] CONTENTS: August 26th, 1921. [No. 2,283.

	Page
The Chinese Market	265
Boiler House Control	266
Electric Arc Welding	267
Economy and the Minimum Charge	267
Charter of Electrical Engineers	267
A Note on the Interconnected-Star Method of Connecting Three-Phase Transformer Windings, by S. Austen Stigant (*illus.*)	268
An Australian Power Scheme, by H. M. S.	269
Household Machinery and the Housewife, by Mary Gwynne Howell	270
New Electrical Devices, Fittings, and Plant (*illus.*)	271
Correspondence—	
Self-Synchronising Rotary Converters.—L.C.C. Tramway Car Design Competition	272
Country House Lighting Plant.—Trade Cards and Trade Discounts.—A Synthesis of Production.—Carpets and the Electric Suction Cleaner	273
Flickering Light.—Accumulator Froth.—Testing and Repairing Magnetos.—Oil Consumption and Prices.—The E.P.E.A. Schedule and Economy Stunts	274
The Electrical Trades Union and Non-Union Labour	275
Power Factor.—I, by E. W. Dorey (*illus.*)	275
High-Resistance Break Test of Submarine Cable, by J. Rymer-Jones	276
Hydro-Electric Power in France (*illus.*)	276
Statutory Companies and the Law of Nuisance	277
Business Notes	278
Notes	284
City Notes	287
Stocks and Shares	287
Market Quotations	288
Leaves from an Inspector's Note-Book, by "Anode."	289
Working Conditions in Factories (*concluded*)	290
The Supply of Electrical Energy in Birmingham and District, by Frank Forrest	291
The Magnetic Properties of Monel Metal (*illus.*)	292
The Lighting of Factories and Workshops	293
Hopeful Signs in Austria	294
Trade Statistics in South Africa	294
Reviews	295
New Patents Applied for, 1921	296
Abstracts of Published Specifications	296
Contractors' Column ... Advertisement page	xxx

"ELECTRICAL REVIEW" SUBSCRIPTION RATES.

UNITED KINGDOM	£1 14 8	per annum.
CANADA	1 12 6	do.
COLONIAL and FOREIGN	2 1 6	do.

Postage Free.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 6d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE, 4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGENRAY, CENT., LONDON." Code, A B C.
Telephone Nos.: Central 8260 and 8261.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 992.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH &c. Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 278, George Street; Gordon & Gotch, Pitt Street.
TOKYO: Maruzen Co., Ltd., 11-16, Nihonbashi-Tori-Sanchome.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 123, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

THE CHINESE MARKET.

A REMARKABLE communication from a Chinaman residing at Frankfort-on-Main, dealing with the industrial training of Chinese students, was published recently in the *Frankfurter Zeitung*. The article brings to mind the fact that as a rule young Chinese and Japanese who come to Europe or proceed to the United States in order to study the industrial and other conditions in these countries, and also to work in them for a certain time, usually return home with a predilection for the manufactures and machinery of the particular countries where they have received most of their industrial education. As these students are frequently those who rise to official and other positions of importance, it generally follows that when they have reached the stage of being able to control business in the departments or branches which they manage, they place the orders which have to be executed abroad, in the countries where they were trained, because they retain the impression through the acquisition of the language and the perusal of the technical literature of the countries concerned that the manufacturers in the latter turn out the best goods in the world, apart from the efforts made by the manufacturers themselves to convey this idea to their pupils.

The author of the communication is Wang Kwang chi, who acts as the correspondent of a Chinese newspaper at Shanghai. After referring to the recent conclusion of a treaty of peace between China and Germany, the author states that all educated people in China are weary of political activity and now devote themselves to the social sphere, and as a consequence the centre of gravity of political influence has gradually passed from the government to the social sphere.

In this respect China is divided into two classes. The one represents the idea of capitalism, and is endeavouring through it to develop Chinese economy. The leader is Tschang Tchien, he is a big capitalist, was formerly Minister for Trade and Agriculture, and is at present superintendent of the commercial port of Wusung. The modern Chinese industrialists and merchants of Shanghai belong to this class. The second class would like to make use of socialism in order to bring about the development of Chinese economy. This class, whose leader is Ysai Yuan pei, Rector of Peking University, is of opinion that China should not enter upon the path said to have been erroneously trodden by Europe. The leader was formerly Minister for Education, and at one time studied in Germany.

Mr. Wang Kwang chi proceeds to state that the Government of the United States has always paid great attention to social questions in China in order to carry out what is termed educational (civilisation) policy. Among these matters is mentioned the return of the Boxer indemnity, so as to permit of the defraying of the costs of maintaining Chinese students in the United States, and for these reasons the relations between America and China are declared to be growing more intimate day by day. The number of young Chinese who are studying in the United States already exceeds 2,000, and the modern Chinese industrialists and merchants are mostly students who have returned from the United States.

We are also told that the French Government has likewise devoted much attention to the social question in China during the past two years. The Rector of Peking University, in conjunction with French interests, has organised the Chinese-French Educational Community, whose object, among others, is to promote the dispatch of an increasing number of Chinese students to France

to study, and the number there also surpasses 2,000. It is noted in this connection that most of those who have been sent to France are young Chinese who represent the idea of socialism. After arrival in France they take an active part as they learn by practical experience in the works on the one hand, and on the other they in this way earn wages and thus raise the expenses for their education. The French Government only collects from these students the sum of 100 dollars each to cover the travelling expenses, and the Government also exerts itself to secure the introduction of the students into works and educational establishments.

The author says that the situation of Germany is now different from that of France, as Chinese students who wish to proceed to the former country do not find the same facilities as those who go to the latter, and there are consequently only about 200 Chinese pupils in Germany at the present time. In his opinion, however, nothing now stands in the way of the Germans forming with the social leaders a Chinese-German Educational Community so that the industrialists in China could then send more students for training in the German works. The industrialists would be able to furnish financial support, although it would be better for the German works to pay wages to the Chinese volunteers, while the duty would devolve upon the Germans to instruct and supervise the pupils. If this procedure were adopted, the author states that on their return to China the students would be able to spread the idea of German education, which would have the practical result that German goods would be purchased to a larger extent.

The pages of the Electrical Review contain a record of the solicitude of German electrical authorities toward fathers of Chinese lads whom, taking the long view, they were anxious to have under their educational influence in Berlin electrical factories in pre-war days. The writer of the article now under consideration states that about 40 or 50 students have been sent to Europe and the United States with the assistance of private capital furnished by large industrialists. As to the difficulty of language, it is considered that this could be remedied in a short time by study; and it is mentioned as an instance that from 60 to 70 per cent. of the students who go to France have no previous knowledge of the language. In conclusion, Mr. Wang Kwang chi expresses the belief that after the lapse of 20 years from now the position of all the Powers in China will change in a great measure, quite irrespective as to whether this will be brought about through the idea of capitalism or that of socialism.

It appears, however, that the engineering training of young Chinese has now been overdone. On this point the Norwegian Legation, in a communication which reached the Government of Norway at the end of July, states that the bulk production of Chinese engineers, both in China and abroad during the past two years, without any corresponding expansion in the industrial life on the country, has placed these engineers in a critical situation. Complaints are being increasingly made to the Government that young Chinese students, who have been abroad at the instance of the Government to obtain engineering training, on their return have to wait a considerable time before they can find any employment, and as a consequence many of them have to enter upon a commercial occupation.

At a Convention of Chinese students held at Swanwick, Derby, on Saturday last, Dr. V. K. Wellington Koo, the Chinese Minister, laid emphasis upon the need of encouraging more Chinese students to come to these islands. He said that the number here was 250 against ten times the number in the United States. Through the students who come here the Chinese people learn about us, our country, our industries, and our business organisation, as well as engineering skill and applied science. The speaker said that the Chinese students' movement must lead to a rapid extension of commercial and trade relations between China and Great Britain: each student and his social circle became channels for the consumption of British goods. The rapid growth of trade between the U.S.A. and China was largely due to the fact that her relationship with the Chinese students was on so large a scale.

A "Correspondent recently in China," writing in the last number of *The Times Trade Supplement*, says there is very little doubt of the desirability of our establishing a closer contact with the Chinese—especially those in the remoter districts. Closer contact implies among other things ability to speak fluent Chinese. When the writer enters into details he states that the British organisation for the sale of machinery and electrical goods is at the present time most open to criticism in this respect. This weakness, however, appears to be recognised, and efforts are being made to improve matters in some measure.

Though Mr. Wang Kwang chi suggests that the foreign training of Chinese engineering students has been overdone, there is reason to believe that the electrical and engineering developments, of which the country is on the verge, should sooner or later absorb all their special knowledge and ability. Yet it is quite true, as *The Times* writer says, and as we have often stated here, that "the immediate consideration in the machinery market is not the present demand, which is admittedly small, but the safeguarding of the future, which has enormous possibilities."

Boiler House Control.

A great deal has already been written on the subject of boiler inefficiency, and there is no excuse at the present day for either engineers or managers to profess ignorance of the subject. It is at last becoming recognised that the boiler house is the place where large sums of money may be either wasted or saved in a power plant, and the up-to-date engineer realises the effects of improved efficiency upon his weekly cost sheets.

It is interesting to analyse the psychology of some of the engineers and managers responsible for the policy adopted in connection with the management of boiler plant in this country.

We have first of all the chief who decides that the installation of certain ornate and expensive instruments will bring about the much desired higher efficiency in his boiler house, and after the expenditure of quite an appreciable sum in this direction, he is somewhat disappointed to find that his ambitions are never realised.

Then there is the engineer who delights in the efficiency of his new turbines, the consumption of which per kWh is jealously worked out to two places of decimals each day, but his boiler house is regarded as being quite efficient because it contains the latest type of steam-raising plant.

Or again, we may have the engineer who, although he probably realises the effects of boiler inefficiencies on the cost sheets, adopts the policy of leaving the operation of the steam-raising plant to the already overburdened charge shift engineers, who may or may not have the necessary training and time to exercise adequate control in the boiler house.

In view of these facts it was quite refreshing to hear Mr. David Wilson discoursing on boiler house management at the recent Summer Conference of the Institution of Mechanical Engineers. In the course of his brief paper, Mr. Wilson dealt with the importance of expert supervision and the necessity of having an engineer-specialist in control of a modern boiler house staff. The raising of status and the payment of adequate salaries to secure competent men were emphasised, and the author laid stress on the fact that immediate action was necessary if results were to be obtained. Undoubtedly, the savings in fuel alone by the adoption of such a policy are sufficient to pay the salaries incurred several times over in even comparatively small plant, in view of the present cost of fuel in this country.

In the case of a plant using, say, 1,000 tons of coal per week, the difference between ordinary supervision and specialised control may quite well result in a 10 per cent. saving of fuel, and this alone capitalised means £200 per week, assuming a coal cost of, say, £2 per ton. There are, of course, other incidental advantages

such as a steady supply of steam, increased capacity of plant, and reduced costs of coal and ash handling, &c., which can only be obtained by the adoption of scientific boiler control.

In some of the large American plant the importance of the boiler house has led to a system of staff organisation which ensures that the best engineers are appointed to boiler room duties, whilst we in this country are still inclined to view the turbine room as being of the greatest importance.

Electric Arc Welding.

The memorandum (Form 329, June, 1921) on the subject of electric arc welding which was recently issued by the Factory Department of the Home Office, is presumably intended to invite discussion fro t those intertsted in electric arc welding, in preparation for the issue of definite safety regulations by the Department. It is, therefore, highly desirable that it should be in the hands of all users and makers of arc welding machinery, to prepare them to meet the official views indicated in the memorandum, and to seek to alter those views if they see any danger to their own interests—without corresponding advantages of safety to the workers—in their crystallisation into definite regulations.

As regards danger from shock, very little exception can be taken to what is said about direct-current welding. Whatever the pressure at the arc, it is the open-circuit pressure when the arc is broken which constitutes the chief source of danger from shock. This, of course, is true for both direct current and alternating current. The memorandum states, as a matter of fact, that up to 100 volts the danger of shock from direct current is practically negligible, whereas the danger from shock from alternating current where the open-circuit pressure is generally from 100 to 120 volts is a real one, and the use of direct current is consequently to be preferred wherever it is, or can reasonably be made, available.

This statement is profoundly modified by a footnote stating that since the memorandum was drafted the Department has been made aware of systems of welding by a.c. in which the open-circuit pressure is reduced to as little as 25 volts. This is in accordance with the most recent developments, and it may be expected that in any regulations the preference for d.c. welding will be deleted, subject to the use of such a.c. apparatus as indicated. As a matter of practice, if direct current is taken from a public supply (3-wire with middle wire earthed) there will usually be 200 volts or more open-circuit pressure, which is decidedly dangerous. It is clearly easier to get the lower pressure by a proper transformer from public supply a.c. mains than by a motor-generator from d.c. mains.

The suggestion that, to avoid shock and short-circuit dangers, there should be a switch in the electrode lead within easy reach of the welder when at work is generally quite impracticable, and it may be hoped will not be found in any regulations. At least it should be limited to fixed working places. Other precautions for avoiding dangers from accidental "shorts" and contacts are reasonable, and such as no careful supervisor or operator can object to.

The protection from the injurious effects of radiations is treated rather tentatively. The trouble is that most effective protection is somewhat cumbrous and awkward to the welder, and he gets careless about using it. Reference is made to the matter elsewhere in this issue in the report of the Chief Inspector of Factories. A very great step in this protection will be achieved when someone finds a screen combination which will stop the injurious rays and yet let sufficient light through to permit the welder to see his tools, &c., as well as his work. This is by no means unattainable. The direction in which to seek it is already known.

Protection from hot metal and slag is suggested in some quite practicable ways. The beginner who lets a few shots drop into the front of his boots and similar crannies of his attire is not likely to neglect them afterwards.

The memorandum does not suggest that the Factory Department proposes to do anything unreasonable or unduly restrictive in the way of safety regulations for arc welding, provided that one can read the footnote on a.c. welding as cancelling the preference for d.c. welding expressed in the body of the text.

Economy and the Minimum Charge.

A contributor to the *Daily News* has a grievance which he may, or may not, share with a number of other consumers of electricity. He complains that although, in response to a request from the company which supplies him with electricity, he reduced his consumption drastically during the coal dispute, and thereby fell far short of the minimum for which the company charges, the minimum price remains the same. He considers that he is, therefore, in effect, paying for his assistance to the community in a time of stress.

Now we know the company's defence already; it will point out that coal prices rose and neutralised the effect of reduced consumption so far as running costs were concerned; moreover, the standing charges continued unaltered. All this is true, but the question is: Will the average consumer view it in that light, even after explanation? There is already a considerable amount of doubt in his mind about the justice of the minimum charge itself, and surely this development will not tend to allay the suspicion that he is being "done."

Thus, although the charge can be fully justified, electricity (or the supplier) secures a bad character.

The course taken by the Bexhill Corporation of suspending the minimum charge for the quarter may, superficially, appear to be "bad business," but the effect of this action may show itself in a certain measure of confidence on the part of the consumer, who will be gratified to see that his contribution towards the general good is not to be penalised. What do the other supply authorities think about it?

Chartered Electrical Engineers.

The grant of a Royal Charter of Incorporation to the Institution of Electrical Engineers, recorded elsewhere in this issue, will be welcomed by all the members and well-wishers of this, the largest engineering Institution in this country, as an important further step in its development; we extend our hearty congratulations to the President and Council on the success of their petition. Thus it has fallen to Mr. Ll. B. Atkinson to celebrate most fittingly the jubilee year of the Institution during his period of office; but he, we are certain, would be the first to associate with this new distinction Mr. C. H. Wordingham, C.B.E., who included in his famous catalogue of projects for the improvement of the Institution and the raising of its status, as one of the most important factors, the obtaining of a Royal Charter. He was unfortunately unable to carry that project to fruition during his occupancy of the chair, but he will share with the sitting President in the satisfaction arising from its accomplishment.

Under the provisions of a Royal Charter, the Institution ceases to be bound by the restrictions imposed upon the conduct of a limited liability company, which at times have been felt to be extremely irksome; far greater scope will be conferred upon its operations, and the prestige associated with its membership will be greatly enhanced.

We think the Council was well-advised in petitioning for a Royal Charter on the basis of the existing constitution of the Institution; thus all questions regarding the effect of proposed changes have been avoided, and the desired end has been attained in less than three months. Necessary changes can be effected as and when they are required—the main thing was to get the Charter, and let the rest follow.

A NOTE ON THE INTERCONNECTED-STAR METHOD OF CONNECTING THREE-PHASE TRANSFORMER WINDINGS.

By S. AUSTEN STIGANT, A.M.I.E.E., M.Am.I.E.E.

The interconnected-star or zigzag connection of three-phase transformer windings is now fairly well established, but so far as the writer is aware, the various reasons for its use have not been given quite the amount of publicity which is desirable. It is with a view to remedying the omission that this article has been written.

In actual practice the connection finds its greatest application when adopted as the method for connecting the secondary windings of three-phase transformers or transformer groups in conjunction with a star connected primary, and the combined connection is frequently used in place of the delta/star connection. It would be as well, therefore, to compare the star/interconnected-star connection with the delta/star, particularly as the latter connection is perhaps the one most widely used, and certainly so in this country. The chief features involved are as follows:—

1. The effect of the connection chosen on the economical limits of voltage and output.
2. Parallel operation of star/interconnected-star with delta/star connected transformers.
3. Unbalanced loading.
4. Harmonics.
5. Availability of neutral point.

1. *Effect of the connection chosen on the economical limits of voltage and output.*—As a high-pressure distribution system extends into less dense areas it is often found that more or less scattered loads of a few hundred kW require supplying, the only voltage immediately available being that of primary distribution which may be, say, 11,000 or 20,000 volts. Now it is at once apparent that there must be some economic relation between the output and voltage of a transformer, other things being equal; in other words, for a given kVA output there is a limiting voltage per phase beyond which a transformer to be supplied could not economically be designed, particularly having in mind the exigencies of standardisation. Conversely, for a given phase voltage there is a minimum kVA output below which it would not be economical to go. The economical upper and lower limits of voltage and output are dictated by considerations of mechanical strength and rigidity of the windings, and not by electrical or magnetic features of the design, so that outside these limits, while the proposed coil conductors might be amply large from the standpoint of current-carrying capacity, losses and voltage drop, they would not be mechanically strong enough to withstand the short-circuit conditions occurring on a large system, nor would they lend themselves to the best methods of modern winding and insulating processes. Such coils would be "mushy" of necessity, due to the inherently low copper factor.

Fig. 1 shows an average relationship between the economical voltage and the three-phase output.

Broadly speaking, we are not so much concerned with the voltage *per phase* for which the transformer is designed, as with the line voltage of distribution, so that if the same, or closely similar operation conditions can be attained with two different types of connections, obviously the one to select is that giving the greatest mechanical strength to the transformer windings.

Consider first the delta/star connection for a step-down transformer of given line voltage ratio.

On the h.p. side the number of turns per phase is a maximum as the phase voltage is equal to the line voltage. The space taken up by the insulation is also a maximum due to maximum number of turns. The cross section of the winding conductor need only be large enough to carry 58 per cent. of the line current, so that in the region of voltage and output limits we have all the characteristics of a "mushy" winding, viz., 100 per cent. turns, 100 per cent. insulation, and 58 per cent. copper section.

If, however, a star connection is used on the primary side the number of turns per phase is 58 per cent. of the foregoing, the space taken up by insulation is 58 per cent. of that taken up by the delta winding (as the best modern practice is *not* to reduce the insulation between turns and layers on account of the star voltage), and the conductor cross section is a maximum as the phase and line currents are equal. Hence a much more robust winding is produced which is inherently better able to withstand the arduous conditions imposed by service on a large system. The total space taken up by the copper and insulation of the high-pressure winding

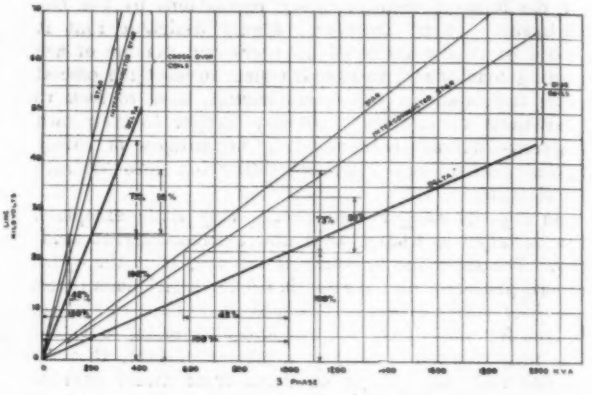


Fig. 1.—Average Relationship between Economic Voltage and 3-phase Output of Transformers.

is, therefore, less with the star connection than with the delta as the total copper section in the coil is the same, but the star connection only requires the same thickness of insulation for 58 per cent. of the maximum number of turns. So far as the high-pressure winding alone is concerned, therefore, a smaller magnetic frame can theoretically be used by adopting the star winding though due to standardisation of parts it may not be found convenient.

Now clearly it is not desirable to retain the star connection on the secondary side with a star connected primary, particularly if loads are to be connected between line terminals and neutral. The reason for this is discussed later. Neither is a delta connection suitable for somewhat similar reasons. If, however, the secondary windings be designed for and connected up interconnected-star the objectionable operating features of the star or delta secondary with star primary for three-phase four-wire service are immediately overcome.

With such a winding, due to the phase difference of the two halves of the windings on different limbs which are connected in series and comprise each phase, the number of turns per phase is 67 per cent. of the maximum, *i.e.*, of those obtaining with a delta connection. The space taken up by the insulation is also 67 per cent. of the maximum, while the cross section of the individual conductors is a maximum as the phase and line currents are equal. Consequently a winding is produced which mechanically is almost as good as a star winding and which, in conjunction with a star connected primary, is electrically as good as the delta/star combination.

So far as the l.p. winding alone is concerned, a slightly larger magnetic frame is theoretically required to accommodate the interconnected-star winding as compared with the straight star, as there is 15½ per cent. more copper and insulation per phase in the former than in the latter. This may be offset to some extent by the gain obtained in using a star connected primary, and often the delta/star standard magnetic frame will ac-

commodate the interconnected star secondary, in which case there may be only a slight increase in cost due to the 15½ per cent. additional copper in the secondary winding, though this depends on the relative cost of labour to materials. It may happen, of course, that the nearest standard frame size suitable for the particular output and voltages will not take the star/interconnected-star winding, so that the net result is a somewhat larger magnetic frame, and consequently increased cost of the transformer.

With, at the most, a small increase in frame size we have, therefore, obtained a design and connection of windings electrically equivalent to the delta/star, and mechanically much stronger, and in addition, one in which the high-pressure voltage per phase is only 58 per cent. of the maximum, *i.e.*, of the line voltage of distribution.

In effect, therefore, the upper limit of line voltage for a given kVA output has been increased by 73 per cent., or the lower limit of kVA output has been reduced by 42 per cent. for a given line voltage by changing from the delta-star to the star/interconnected-star combination.

Due to the higher copper factor the secondary l.p. winding takes much less room in proportion to the h.p., and for the purpose of this argument can be ignored.

Given, therefore, equal possible technical performance of the two combinations, this is the main reason for using the star/interconnected-star connection for an ordinary step-down transformer supplying a consumer direct.

2. *Parallel operation of star/interconnected-star with delta/star connected transformers.*—With regard to the question of parallel operation of star/interconnected-star transformers with delta/star transformers, it is

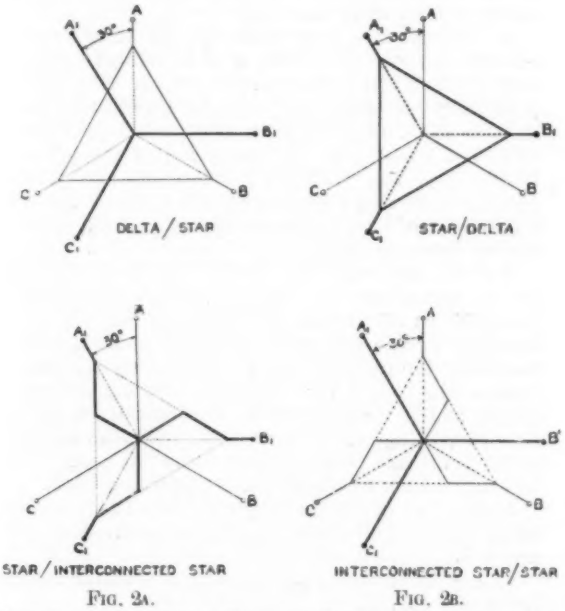


Fig. 2A. Fig. 2B.

Figs. 2A and 2B.—Vector Diagrams Comparing the two kinds of Combined Connections.

not necessary to go into this here in great detail, and it is sufficient to state that delta/star connected transformers or transformer groups will operate satisfactorily in parallel with any star/interconnected-star transformer or transformer group. This holds good whatever the meshing of the phases may be or whatever may be the direction in which the primary and secondary coils are wound, and it is only a question of selecting a proper set of external connections from the transformer terminals to the busbars in each case.

It has already been stated that electrically a star/interconnected-star transformer is equivalent to a delta-star connected one, though no proof has been given for this. The fact can best be illustrated by means of a vector diagram, and fig. 2a shows a comparison between the two kinds of combined connections. From this it will be seen that there is the same angular displacement in both cases between primary and secondary terminals, viz., 30 degrees, and therefore both primary and both secondary line currents and voltages are in phase.

Of course, cases may also occur in practice where the interconnected star winding is required on the primary side to be used in conjunction with a star-connected secondary, and in this case the connection would be electrically equivalent to the star/delta. Fig. 2b shows a comparison between these two combined connections from which it will be seen that there is again the same angular displacement in both cases between primary and secondary terminals.

3. *Unbalanced Loading.*—One great advantage of the delta/star connection for step-down distribution transformers is that a three-phase, four-wire, supply may be given without appreciably distorting the position of the neutral. The four-wire supply need not necessarily be balanced, in which case the resulting distortion of the neutral is simply due to the out-of-balance current flowing through the impedance of the phase concerned. There is no choking effect as the primary current corresponding to the secondary out-of-balance current has a perfectly free path through the primary winding of the phase concerned and the two line wires; the other two phases are not affected by the out-of-balance current.

(*To be concluded.*)

AN AUSTRALIAN POWER SCHEME.

By H. M. S.

A special supplement to the *Industrial Australian and Mining Standard*, entitled "Power for Victorian Industries," has been sent to the writer for review, but a review in the ordinary sense of that word is hardly appropriate to a publication evidently designed to inform the Victorian public of the plan for the provision of electrical energy for Melbourne and other towns, and to raise some interest which may later display itself in a practical form.

The scheme is that known as the Morwell brown coal scheme, which has been mentioned in various ways in Australian contemporaries and in these pages for some time past. The plan was drawn up by Mr. C. H. Merz, specially engaged by the Victorian Government. It has the particular interest of combining coal production with the supply of electrical energy, and shows what can be done where one is so fortunate as to have a clean slate, with no vested interests to conciliate or acquire.

Melbourne finds itself near the limit of its present power houses. The Government wishes to develop home industries, and has appointed a body of Electricity Commissioners first to advise on, and later to carry out, the necessary power supplies, as well as to control electricity undertakings generally in the State.

At present the State depends for its fuel on coal imported from Newcastle, N.S.W., the price of which has risen greatly of late years, and the supply of which has been irregular lately as the result of labour troubles.

So the Electricity Commissioners studied the possible sources of power supply. There are some water powers in the State, but they require heavy expenditure to develop, and the works will take a long time to execute. Recognising that these resources may be of future value, they have determined that the readiest plan which will give early results is to utilise the very large beds of brown coal at Morwell, in the valley of the Latrobe river, about 90 miles south-east of Melbourne, not far from the Gippsland main railway, and with a branch line off that already built to the coalfield. The coal lies in thick beds with an overburden of from 30 to 80 feet of alluvial, so that it can be worked by open quarrying. Both the overburden and the brown coal can be excavated by steam navvies or other mechanical diggers.

The conditions are not unlike those of the German brown coalfields at Fortuna and elsewhere, and the scheme proposes to utilise similar methods to those there employed. The coal is State property, and has been proved by borings to exist over a wide area. There are other thick beds below the top one above described, but it appears that the upper one will provide for a good many years' working. The cost of quarrying this coal by such means is reckoned at only 2s. 3d. per ton. Its calorific value is low; indeed, as mined, it contains nearly 50 per cent. of water, but as Newcastle coal costs 32s. 9d. per ton at the Melbourne wharves, the low cost will make up for low heating value. From a number of calorimeter and boiler tests, it is estimated that it will take 2½ tons of this coal (air dried down to about 20 per cent. moisture) to equal one ton of Newcastle coal, when burned in properly-designed boilers. It is not clear from the description whether the method of firing has been settled; briquetting and powdering are both mentioned. Powdering should be a fairly cheap process; briquetting will probably be used, as it is in Germany, to make some of the output suitable for transport, for ordinary use. It appears, indeed, that the idea is to make Victoria independent of its neighbour State for coal supplies.

The power house at Morwell has been designed by Messrs. Merz & McLellan for an output capacity of 50,000 kW at its first stage, with turbo-alternators generating at 11,000 volts, to be stepped up to 132,000 volts to the duplicate overhead transmission lines to Melbourne.

It is estimated that the energy can be delivered to the 20,000-volt distributors in Melbourne at about three-fourths of the present cost from the existing stations there using Newcastle coal.

The whole scheme involves much more than has been described. It will be necessary to build a new town at Morwell to accommodate the miners and other employés, and plans for this modern industrial town are in course of preparation. The country appears from the descriptions given to lend itself to real garden city conditions. It is undulating, with a considerable river, and sparsely inhabited. It was, when first explored, well wooded, but the not very successful attempts at settlement for sheep raising brought about the destruction of the forests.

Besides supplying the power house and briquetted coal for general use, it is hoped to distil some of the output for the production of oil, tar, sulphate of ammonia, &c., and gradually to develop a chemical industry based on these by-products.

The future development of the water power elsewhere is evidently linked up with irrigation and the fostering of agriculture.

It will be noted that the scheme means a considerable amount of nationalisation, but under all the circumstances, this may possibly be the only method by which such a far-reaching combination of objects of public interest can be made effective. The fact that there are no private interests to be compensated or conciliated is favourable to State enterprise. Development of a country with great potential resources, and a very small population, is something like afforestation; it takes a long time to become actively remunerative, longer than the private investor can afford to wait for returns. A Government can take longer views and plan for future benefits.

The publication gives a good deal of interesting history of the early exploration of this part of the State, and is written in a style to arouse enthusiasm and hope. It will be very pleasant to hear that the scheme is working out according to plan in all its phases.

When it is remembered that the population of the whole of Australia is about that of the Administrative County of London, and its area over 1,400,000 square miles, say, twelve times that of the United Kingdom, it will be realised that the success of large schemes of industrial and agricultural development may have a very important and beneficial result on the future of the British race.

HOUSEHOLD MACHINERY AND THE HOUSEWIFE.

By MARY GWYNNE HOWELL.

The average English housewife is too new to the wonders of electricity for general household purposes to make a whole-hearted bid for the all-electric house unless she can be quite convinced that the equipment is going to prove an all-round blessing. She "trembles on the brink," having been pushed that far by the overwhelming burden of housework performed by human labour, old-fashioned methods, and the lack of domestic help.

Yet she is fearful to avail herself of the wonder-working appliances she sees on every side, for several reasons.

1. The apparent high cost scares her.

2. She knows nothing of mechanism and fears to experiment.

3. Shop demonstrations are given under conditions totally different to her home surroundings.

These difficulties can best be dealt with by understanding the woman's point of view, and meeting her on her own ground.

In all explanations it must be remembered that if the housewife is ignorant of the workings of machinery, on the other hand, she knows methods of housework from A to Z, and it is worse than useless to try and convince her that a washing machine, for example, plus a pail of hot water and an indiscriminate sprinkling of soap powder, is going to accomplish all her washing while she gets on with her other work! Such "lore" is fatal to the general adoption of machinery, since one disappointed housewife who spreads the news of failure has more influence on her friends and acquaintances than all the spectacular window demonstrations. The sellers of household appliances need the principles of housewifery behind their teaching.

As regards the cost difficulty, the average woman purchaser can be won over, if it is pointed out to her that if the original outlay is somewhat costly, this is practically the only cost, and the long-lasting results show it to be an investment which will repay the cost over and over again in the saving of time, energy, labour, and wear and tear, as well as money. This puts the matter in a fresh light, and gives the housewife a true idea of labour-saving appliances as an economy, not an extravagance.

It is not altogether easy for one versed in mechanical lore to understand the total ignorance of the ordinary housewife on all matters pertaining to machinery, and therefore it does not occur to the salesman to give the necessary instructions to a would-be purchaser. A woman who buys a vacuum cleaner expects it to act by magic, and if the magic fails she discards the machine as a poor thing, and goes back with fortified adherence to her brush and broom. Every time this occurs it is a serious set-back to the electrical appliance trade.

A summary of the teaching necessary for housewives, apart from detailed explanations of individual appliances, is as follows:—

1. *The directions supplied with a machine must be followed minutely.*

Good results cannot be expected if wrong use and handling take place. Every detail of the instructions is important and should be faithfully carried out by the operator of the appliance.

2. *The machinery must be kept in a condition of absolute cleanliness.*

Satisfactory service is impossible if the appliance is clogged with dust or allowed to become rusty.

3. *The use of every appliance must be strictly confined to its own particular work.*

Unlawful use is a frequent cause of deterioration. A vacuum cleaner is not intended as a polisher of floors, nor is an electric iron designed for a door stop!

4. *Frequent oiling is necessary with all machinery.*

Unless some lubricant is applied to all the moving parts, the constant friction will result in scoring and grooving, but a film of oil between metal faces in the

hinges, and around bolts and screws, will lessen the wear and tear to a marked degree, and consequently lengthen the life of the appliance.

5. *Great care must be taken of the connecting cord.*

It contains the wires that transmit the power necessary to operate the machine, and knotting or twisting this cord or any excessive wear on any portion of it will shorten its life and affect the usefulness of the machine.

The faithful observance of these simple rules will in many cases guard against failure, and the housewife, thus fortified with knowledge, will be much more confident in her attitude towards labour-saving appliances.

A word as to "telling" arguments for selling purposes.

In the case of a vacuum cleaner, for example, it is possible to impress a woman favourably by explaining that the life of her carpets and rugs depends upon keeping them free from gritty dirt, which is ground into the pile by every pair of shoes treading on them. *Grit, plus the tread of heels, is the most destructive combination possible.* From this the obvious deduction can be made and used as a text, *i.e., a clean carpet has the longest life.*

Having got the housewife to see the importance, from an economical point of view, of thorough cleanliness, it should not be a difficult matter to convince her of the superiority of the suction method over the brush and broom.

1. It is more thorough.
2. It is more sanitary.
3. It is more economical.

The possibilities of a washing machine properly used have already been dealt with, but since the use of such a machine makes it possible to wash sheets and table linen at home, it follows that the "aftermath" of laundry work (the ironing operations) call for equally efficient labour-saving appliances. For this purpose the merits of the roller ironer may well be extolled, since the speed and efficiency with which the ironing can be accomplished with such a machine save hours of time and an immense amount of human energy. A seeming drawback to such a machine is sometimes pointed out in the fact that it cannot iron "gathered" garments, but as a matter of fact, it is quite possible to iron all but the actual gathers themselves in the machine, releasing the shoe just before these are reached. The amount of hand ironing is thus reduced to a minimum.

The investment idea will here again overcome the cost difficulty, especially since such large articles as sheets, counterpanes, tablecloths, &c., are priced so highly at the commercial laundry.

The position in which the average housewoman finds herself to-day, obliged to play the double rôle of mistress-maid, is in itself quite the most telling argument in favour of a general adoption of labour-saving equipment, and it should not be a difficult matter to overcome the prejudices and ignorance which are the chief stumbling blocks in the way.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Conduit and Pipe Cleaning Device.

So far no effective method has been employed to blow down obstructions thoroughly in pipes, particularly electrical conduit that is placed in the walls or other positions during the construction of a building, and which is liable to become clogged during the time that cementing or plastering is being accomplished.

A device has been patented in the United States, however, by Mr. E. G. Cheuvreux, Junr., of 710, Leonard Street, Brooklyn, N.Y., and will probably be placed on the market in the near future, that will, it is said, blow down any foreign matter in conduit, such as wooden plugs, waste, cement, plaster, and even ice, and on a test it blew through 200 ft. of conduit, around elbows, carrying before it all material in the tube.

The principle of the device is concussion, and the tool itself is simple in construction, easily handled, and, it is claimed, safe. Conduit is usually provided with screw threads on the exposed ends to which fittings are screwed, and it is to these exposed threaded ends that the device is attached.

Fig. 1 shows a sectional view and details of the device. Through a longitudinal passage the firing pin passes and

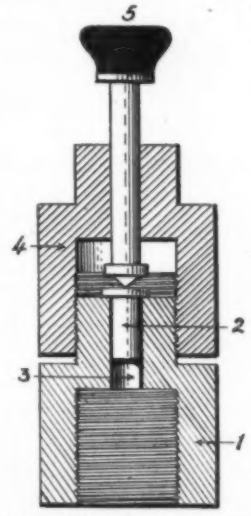


Fig. 1.—A Pipe-Cleaning Device.

operates freely, so that there is no effective pressure until the time desired. There is also a spring used on the firing pin, so that it rebounds after discharging the cartridge, but this is not shown in the sketch.

The device is operated as follows: Member (1) is screwed to the pipe, and this member can be made any size to suit the diameter of the pipe, and can be used on two sizes of pipes by means of reducers, and also on elbows or any fitting attached to the pipe. A blank cartridge (2) of .32 calibre is then placed in the passage (3) with its flanged end resting on the face of the passage. Member (4) is then firmly screwed to the latter, and a blow of a hammer on the knob (5) will explode the cartridge. The explosion in the pipe will cause sufficient pressure to blow out all foreign matter; if a single cartridge does not accomplish the work effectually, a second or even a third cartridge may be used, but as a rule it will be found that one will do the work.

A New Brush Holder.

The Corlett Electrical Engineering Co., Ltd., Wilcock Street, Wigan, has recently placed a new brush holder on the market. The special feature of this holder (fig. 2) is that no

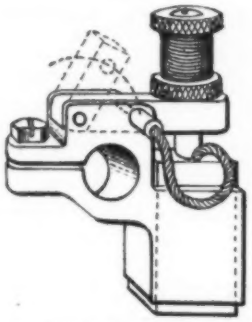


Fig. 2.—The "ParKir" Brush Holder.

pressure is put on to the brush until the top portion is held in position by the retaining pin on the end of the flex. In this way complete contact is ensured. No tools are required when changing the brushes, and the spring is totally enclosed. The holder is known as the "ParKir."

A New Belting.

Messrs. Essenhigh Bros., 27a, Green Street, Warrington, have sent us particulars of a new type of belting which they are manufacturing. This belting, the "S.N.I Patent Link V Belt," is intended for high-speed drives of all kinds. The belt is made up of leather links connected by small metal links. A brass bush runs right through each connecting point, and thus the strain is taken off the leather. These brasses are retained by small screws sunk into the substance, there being no projections at all. The links have an air space in the centre, which, it is claimed, effectively cools the brasses when the belt is in use.

The "Agraf" Switch.

We have received a sample of a new type of switch introduced to this country from Germany by Mr. T. M. Summers, 8, The Mall, W. 8. This is a three-position switch of very compact design. The base, which is of porcelain, has a raised centre with four steps—three contacts and an "off" position. The operating knob and contacts are contained in a domed porcelain cover, and are assembled as a part of the cover. The spring beneath this contacts serves also as the cover's retaining spring, and the cover instead of being screwed on to the base, as is usual, is held by two small brass projections which slide into slots in the cover. Correct alignment is obtained by means of a steel pin which enters the centre of the base. The switch is very neat in appearance, and, so far as can be judged, likely to prove efficient, and it is unfortunate that it is not a British invention. The sample is rated at 6 A, 125-250 V, but larger sizes are being made.

The "Dictograph" Telephone Junction Box.

We reproduce an illustration (fig. 3) of the new "Dictograph" telephone junction box, which has now been placed on the market for the first time by Dictograph Telephones, Ltd., Aurelia Road, Mitcham Road, Croydon.

For many years this box has been successfully used in the "Dictograph" telephone installations, by some of the biggest engineering concerns in the country, but it can also be used for other apparatus which employs multi-core cable, such as annunciators, and large systems of bell indicators for hotels.

The chief feature of the box is that all connections are

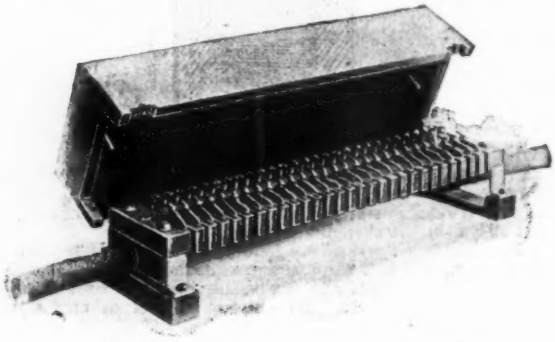


Fig. 3.—The Dictograph Junction Box.

soldered. Each lug, made of heavy tinned wire, will take three conductors, and each junction box three or four main cables. There is ample room behind the base of the box to lace and form the cable, and when fixed to the wall, the cables are entirely hidden, only the soldered ends and colour code being visible from end to end. The box is completely enclosed in a hard-wood cover which can be obtained in a variety of finishes to match the furniture of the room in which it is placed.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Self-synchronising Rotary Converters.

In answer to "1,500 kW's" letter, I have attempted the following elementary explanation of the self-synchronising of a rotary converter.

The problem is this: We must get a synchronous motor (for a r.c. viewed as an a.c. machine is really a synchronous motor) up to synchronous speed, while we have at our disposal a 3-phase supply of constant frequency and voltage.

We cannot, of course, apply the working voltage directly across the slip-rings of the machine while at rest. This would be equivalent to shorting the supply through the rotary armature. But we could easily apply the same voltage to the machine, if we put in series with the armature a suitable choking-coil; all the supply e.m.f. being taken by the choker and none, or practically none, by the armature itself. If, now, this choking-coil—I am at present considering one only of the three phases of the machine—be in the shape of the stator-winding of an induction motor, which will start our rotary, so much the better.

Again, this starting induction-motor has a lesser number of poles than the rotary, *i.e.*, its synchronous speed is higher than that of the rotary, so that the machine is bound to pass through its synchronous speed while accelerating.

How will it stop at that particular speed? Thus: Consider for a moment the rotary as a shunt d.c. generator. When speeding up it tends to excite, quite an appreciable field being maintained. We have, therefore, again our synchronous motor coming up to speed and having a strong field as well.

At the particular instant when it is exactly in synchronism with the supply, the well-known strong torque of the synchronous motor comes into play and keeps it there.

The induction motor being now rid of almost all its load, the supply current falls down to that value which will suit the synchronous motor (*i.e.*, the rotary), and the voltage across the former diminishes and is simultaneously transferred to the rotary armature. A further reduction can be made by adjusting the rheostat in the rotary field-circuit, when the induction motor can safely be shorted out of circuit.

Our rotary is now straight across the supply and running at synchronous speed.

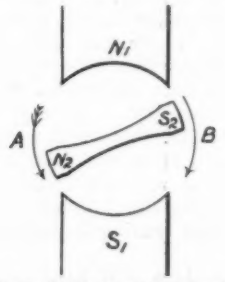
The above explanation is, I repeat, very elementary, but, I hope, clear enough to suit its purpose.

M. L. C.

August 18th, 1921.

In reply to "1,500 kW" *re* the "self" sychronising rotary converter, may I, without the aid of elaborate vector diagrams and calculations, submit to him the following theory, which is true for all numbers of poles and phases.

Consider N_1S_1, in the figure, to represent a two-pole revolving field produced by the stator supplied with 3-phase current. N_1S_1 will not, of course, actually be salient poles as indicated, but will be "polar regions." N_2S_2 will represent the two actual salient poles of the rotor. At the time of starting the speed of the rotor is much below that of the stator field N_1S_1, and consequently much below that of synchronism. At the speed of synchronism, the speeds of N_1S_1 and N_2S_2 will both be equal, and one is at rest with respect to the other. Imagine the whole to be given a backward rotation equal to the speed of synchronism so that N_1S_1 will be brought to rest; however, at starting, N_2S_2 will move in the direction of the double arrow A with synchronous speed when it first starts from rest, and as the rotor body gains speed in the direction of the single arrow B, so the imaginary backward motion of N_2S_2 with respect to N_1S_1 decreases. As the poles N_2S_2 sweep by the polar regions of the stator, N_1S_1, the former experience an alternately retarding and accelerating torque by the laws of simple magnetism—"unlike poles attract, like poles repel." Hence, superposed on the driving torque—due to the prime mover or induction-motor-action, according to the type of machine and method of starting—we have an alternating torque caused by the fact that the



A = Relative direction of rotor-field before synchronism is reached.
B = Actual direction of rotor-body given by prime mover.
N_1S_1 is always at the speed of synchronism, but is at rest in the diagram by assuming the whole is rotated backwards at synchronous speed.

rotor has well-defined poles. So long as the speed falls well below that of synchronism, the effect of this alternating torque is slight, as each half-wave of torque is of short duration and the corresponding impulse (mean torque × time) is not enough to affect the speed materially. But as synchronism is approached, the impulses of these alternating torques have longer, *i.e.*, slower periods, and therefore increase in value, and oscillations are imposed on the uniform rotation of the rotor. Finally, at a certain speed just a little below synchronism, the impulses become powerful enough to jerk the rotor field into step (synchronism) with the stator, and after that synchronous rotation is maintained.

The residual magnetism of the rotor field is sufficient to cause a machine to pull into synchronism, but, unless Dr. Rosenberg's series motor method is used,* it is easy to see that N_2S_2 may be reversed by induction from a strong N_1S_1, and the rotary will come up with the wrong polarity, necessitating the well-known "pole slipping."

W. T. P., Wh.Ex., Student I.E.E.

August 10th, 1921.

L.C.C. Tramway Car Design Competition.

It will be remembered that about a year ago the L.C.C. tramway authorities organised a £1,000 car design competition. The fact is kept fresh in one's memory by the articles recurring in the lay papers, ridiculing those unwitting enough to have paid the necessary two guineas.

---

* Note.—For Dr. Rosenberg's method of starting self-synchronising rotaries, see I.E.E. Journal, Vol. II, p. 77 (1913).

"Sardine Tin" tramcars, &c., are doubtless entertaining to the ignorant; that the misguided entrants are either humorists or lunatics is comforting also to the reader—an "official" of the L.C.C. said so (lucky for him he was debarred from competing)—and note that these scurvy diatribes are the *only* "official" statements that have been published; no rational report to a technical journal, upon those designs which show that the designer to have understood the technicalities and shortcomings of his subject, and made an engineering attempt to improve it.

Here it should be stated that to comply with the conditions of competition required a knowledge of mechanics, also drawings costing anything from £20 to £60.

Then why this Judas attitude of the L.C.C.? The fact is, officialdom's sold its soul (and the competitors) for that £1,000.

Finding, what their technical advisers should previously have known, that mere mortal could not by magic improve that which is the product of a dozen, at least, independent specialists, they repented of the £1,000 offer. But certain gentlemen, influential in the tramway world, having reason to know, cast certain doubts upon the honesty and even the legal tenability of their position.

So why not smother criticism by appealing to the readers of *Puck* with "Sardine Tin" tramcars, complete with tin-opener; picture them an orange box on four scullery boiler covers, motored from a cat's interior scratched backwards on a revolving broom. Never mind immolating the few innocents on the pyre of contumely.

The L.C.C. says "many" entrants were either humorists or lunatics; the insult applies to *all*. I say "some" tramway undertakings (or is it overtakings?) are unscrupulous and heartless. Let the L.C.C. if the cap fits

B. Lloyd Price.

Newport (Mon.).
August 17th, 1921.

Country House Lighting Plant.

Having read Mr. H. R. Taunton's interesting article on "Automatic Lighting Sets," I am surprised to see no mention of a type made by the Kohler Co., of America. So far as I remember the main details are as follows: The petrol fuel is vacuum fed from a tank sufficient to last over a month. There is no lighting battery, but a 12-volt battery is used to automatically start the engine as soon as the first lamp is switched on, and when the last lamp is switched off the engine automatically stops; hence no power is wasted.

P. F. Roberts.

Hertford.
August 16th, 1921.

Trade Cards and Trade Discounts.

The letter from Messrs. Allen & Son, of Gravesend, in your issue of July 29th, to my mind opens up a very big subject. It is not possible to stop a dishonest person from using, say, a traveller's visiting card in order to obtain a trade discount. This, however, might be minimised if the trade as a whole would resolve what firms or persons should be entitled to trade discounts, say, not without an official order or its equivalent. There are trades where no discount is allowed even to the larger firms outside their circles, an agreement having been arrived at in the particular trade and rigidly adhered to. The engineering trade as a whole, however, as far as my experience goes, makes no inquiries from the purchaser if he seems to have a knowledge of the discounts when purchasing.

I came up against this matter only a few days ago. An inquiry was received from two electrical firms; a quotation was sent to each, identical in price; the order was received from one and a letter from the other grumbling because we had stolen his customer. This makes things very awkward. Offence was not meant, and I considered myself a victim of circumstances, as I have little doubt that my competitors quoted on the same lines.

Interested.

August 16th, 1921.

A Synthesis of Production.

I do not know to what extent the various manufacturing companies have developed the system of recording the progress through the factories of the various orders which they receive for their standard productions.

I believe that a carefully organised progress department could serve two very valuable purposes. First, to prevent material, upon which considerable sums of money have been spent, lying about the shops which are waiting for some, possibly small, piece of mechanism from another department. Here, I would say, that shop managers, shop foremen, and shop clerks are all very human, and it is to expect more from ordinary human nature than is just, to expect the man in charge of one department to chase round into another department and collect the small parts of a machine necessary for completion. The head of a department might say that he had enough to do to keep up his output without worrying anybody else in the factory. Very often the delay, say, of a month, could be accounted for by the waiting for these small additions necessary to complete the order.

The other point which I think a progress department would bring out to the advantage of any manufacturing concern is coherence in delivery dates. It is extremely difficult for a head office which is directing the affairs of a company to keep track of all promises of delivery given. Experience shows that, day by day, the sequence of delivery has to be modified on account of relative urgency of different orders, and some very valued customer might find that his requirements had suddenly developed an urgency that was not apparent when he placed his order, and he would naturally get in touch with the head office of a company to know whether his order could not be pushed forward, and this is one of the occasions on which a good progress department could supply the head office with all the data. For every order or part of an order should be booked out from one department into another by the shop clerks, and it would be possible for the progress department of the factory to give the head office the exact history of that order, as to where it stands and the possible date of its completion and, at the same time, give the head office the necessary information as to what orders stand in front of that particular one, and will occupy the machines in advance of it, so that the head office could then give instructions to the factory as to which order should take precedence.

It should be borne in mind that the progress department would have a necessarily more comprehensive view of the company's interest rather than that of the factory which is mainly concerned with production pure and simple.

I think it is possible to organise, at comparatively small cost, a progress department dealing with all orders received by any factory. In such a way the actual position of any order could be ascertained in a few minutes and definite instructions could be received in a factory, conditioned by the knowledge of any of the company's interests as a whole, which is more likely to be held in the head office than in the factory.

In every complex form of manufacture, even with the most carefully thought out scheme of mass production, either stock orders on factory orders must come through from one department to another and so on to another, and with a carefully organised progress department all this information could be given on the telephone from the factory to the head office. These two points which I am advocating, the ordered sequence through a factory of materials for production (eliminating the cost of half-finished materials waiting), and the power conferred on the head office to give a reasoned date of delivery, would be safeguarded.

Human nature being what it is, I venture to think that customers are likely to be pleased rather than otherwise at receiving a date of delivery based on the whole effects of manufacture rather than the cheery optimism that is sometimes evinced in dates of delivery given by those who hope for the best.

D. P.

August 18th, 1921.

Carpets and the Electric Suction Cleaner.

I have read with interest the article on vacuum cleaners, and as an engineer who has spent many years in this particular line, I would like to point out to your correspondent (who appears to favour a foreign machine) that a machine that is properly designed will, without the assistance of a brush, take practically every morsel of dirt out of a carpet.

Now, he is an expert on carpets, and in his position wishes to safeguard his antique carpets. I am an engineer with wide experience of vacuum cleaners. Will your correspondent be interested enough in his property to allow me to give him the benefit of my experience, and, if required, take actual tests in his carpet store? I will then prove to him that: (1) The best vacuum cleaner on the market is British; (2) has no brush; (3) runs at a lower speed than any other machine (and has in consequence a longer life); (4) is more robustly made than any other machine, and is, therefore, a sounder proposition than competitive machines; (5) that all parts are standardised and interchangeable; (6) that soft-hair bristles are not powerful enough to depress a carpet that is lifted by powerful suction; and hard bristles do take the pile off a carpet.

Trusting that I may have the pleasure of meeting Mr. Kemp in the near future.

G. M. Oates.

London, S.W.
August 22nd, 1921.

We have read with interest the article appearing in your journal under the heading of "Carpets and the Electric Suction Cleaner." To any person connected with the electric suction cleaner business it is obvious to what particular machine the writer refers. So why not state the name—"Hoover." The so-called tests which the writer claimed to have submitted his delicate oriental carpets to, appear altogether too vague to be convincing. He mentions "this simple addition of a motor-driven brush to a *powerful* suction cleaner" (the italics are mine). The machine in question, like all the American-produced cleaners, has not a powerful suction, and unless it were fitted with a brush, to incorporate the old-fashioned

idea of beating and sweeping, the suction would not be sufficiently powerful to take up even the surface dust or dirt.

There is no misunderstanding respecting the fact that motor-driven brush machines extract the pile of the carpets cleaned. Most people are well aware that there is always a certain amount of loose pile on a new carpet which has to be taken off by whatever cleaning method is employed, but the users of vacuum cleaners are beginning to appreciate the fact that they are destroying their carpets when they find that they always extract pile or nap, even after constant use of a motor-driven brush machine. This is readily proved by an examination of the contents of the dust bag.

Embedded grit or dust extraction from any fabric is purely a question of suction, but that suction must be sufficiently high to loosen and pull the dirt out of the fabric.

It is possible to obtain electric suction cleaners, which are solely *suction* cleaners, and not a combination of a vacuum cleaner and a broom—machines which have ample suction to extract all the embedded grit and dirt out of any fabric without brushing out the pile or nap.

A recent test, carried out in one of the most efficiently equipped research laboratories in the world, proved that the "Magic" suction cleaner—no brush—extracted within five minutes 97 per cent. of the dirt from a *saturated* carpet, against 61 per cent. extracted by an American machine.

Yet intending purchasers of cleaners should well consider the different merits of the various machines available prior to purchasing, bearing in mind that carpet cleaning comprises only one of the duties of a suction cleaner. Hanging tapestries, chairs, beds, book-cases, pianos, and stairways, &c., have to be cleaned, and there are various machines that have to rely upon suction alone, and this is where the American vacuum cleaners fail, because they have insufficient suction to operate efficiently.

Magic Appliances, Ltd.

London, S.E. 1.
August 22nd, 1921.

Flickering Light.

I have read with some interest the report on Factory Lighting, with its suggestions as to the production of flickering and uneven light.

Also I noticed at the British Industries Fair, Birmingham, our principals' stand was supplied with a very flickering light. On inquiring the reason of this, I was informed it was due to the supply being at 25 periods in that part of the Fair buildings (other parts were supplied with d.c.).

Now I see that 25-period supply is to be standardised in the Birmingham and Shropshire and Worcestershire power area, and this makes me wonder if lighting is to be on the 25-period system, and whether this will be suitable for factory lighting. Speaking personally, I found it highly fatiguing and discomforting at the Fair, and would rather have oil lamps in my home than this.

You will understand that I am not an electrical engineer, and this is my first acquaintance with a 25-period lighting supply. I am a constant visitor at a colliery where it is used for power, but they have a separate d.c. lighting circuit, and say their a.c. supply is unsuitable for the purpose.

L. R. I.

August 19th, 1921.

Accumulator Froth.

I have noticed that when a celluloid accumulator has been placed on charge for two or three hours a froth oozes through the vent plug.

This never happens with accumulators other than of the celluloid type. The accumulators are always charged at the rate specified by the makers. Could you please tell me the reason?

Curious.

August 17th, 1921.

Testing and Repairing Magnetos.

On the subject of magneto repairs in your issue of August 19th, I quite agree with Mr. Perry that there were Service men who did not have the slightest idea of testing or repairing a magneto. But I saw quite good repairs carried out by Service electricians. The repairs consisted of testing, re-winding, re-magnetising, drawing off and fitting new slip-rings and ball-races, &c. After the repair, the parts were tested, and the whole assembled and run at various speeds, and the timing was checked before being passed out of the shop. An electrician when out with a repair lorry was only provided with a pair of pliers, a roll of adhesive tape, a screw-driver, and a few tools borrowed from the fitter's kit, so he could not do much away from the shop in any case.

J. H. Owen.

Ruabon.
August 21st, 1921.

I quite agree with all the remarks of Mr. J. Perry on this subject, particularly those about ex-Service electricians. My experience is that the only magneto repair ever done by a Service "electrician" was to take off the magneto, scrap it, and replace it with a new one. I am quite satisfied that there are one or two firms which have a good system of dealing with repairs, but they guard it as a "trade secret," and think it is to their advantage to do so—an idea which has been exploded long since in other branches of electrical work. Surely this lack of knowledge (or apparent lack) on one of the most every-day matters in the electrical industry is a disgrace to this industry, which prides itself on having applied scientific methods and theoretical principles to its practical work more closely than any other industry.

The only way in which this can be cleared up is by everybody placing on record the best methods, tests, machines, and materials he has used or seen used; it should then be fairly simple to pick out the best of these good methods, and as a result everybody would benefit.

Would Mr. J. Perry let us have a sketch of the infallible "race puller" he mentions?

Mag.

August 20th, 1921.

Oil Consumption and Prices.

The writer has been specially interested in the letters contained in your issues of July 29th, August 12th and 19th, referring to "Oil Consumption and Prices."

As no mention has yet been made of the consumption of oil in high-speed steam engines, perhaps the following information will be interesting to readers of the ELECTRICAL REVIEW.

At a neighbouring colliery a 400-kW high-speed steam engine has been running practically continuously for eighteen months, always up to load and very often 25 per cent. overloaded, and during this time has used 50 gallons of oil. The temperature of the oil has never exceeded 110 deg. F., and the engine has required no maintenance attention whatsoever. With the capacity of the engine in kW as 400 and the kWh generated per week as 67,200, we find the oil consumption to be .0000097 gal. per kWh generated.

On comparing this consumption with those mentioned in your issue of the 12th inst., it is at once seen to be exceptionally low—almost incredibly so. The result, however, is obtained by the introduction of a recently patented oil-cooler working in conjunction with the engine. This cooler is also adaptable to steam turbines and internal-combustion engines fitted with forced lubrication.

Robert Scott,
The Economy Oil Cooler Co.

Swansea.
August 22nd, 1921.

The E.P.E.A. Schedule and Economy Stunts

The insistent craze for economy, which is so prominent a feature in public life at the present time, is doubtless the inevitable aftermath of the orgy of expenditure during the war. The necessity for retrenchment in every direction in which such can reasonably be accomplished is obvious, and most people are awake to the fact that the spendthrift habits acquired in recent years must necessarily be replaced by those of greater prudence.

Unfortunately, to many minds economy is synonymous with low wages. The more or less drastic cuts in the remuneration of employés, which have been, and are being effected, is evidence of this point of view. "Wages must come down" is preached to us from the pulpit of the Press; shrieks at us from every hoarding.

As with wages, so with salaries, and it would be too much to hope that the "emoluments" of the technical staffs in the electricity supply industry should escape the prevalent epidemic of economy.

In point of fact, there have been two recent determined attempts to effect a radical reduction in staff salaries and to throw overboard the E.P.E.A. Schedule, viz., at Dover and Perth. In both cases, thanks to the resolute front shown by the members of this Association, the move was successfully countered.

It is well known, of course, that the Schedule includes a sliding scale for the periodical adjustment of salaries according to the Government figures for the cost of living, but this provision evidently was not sufficient to satisfy the voracious appetite of the Hotspurs of economy, whose zeal for retrenchment rendered them oblivious of the fact that they had but recently accepted and approved of the Schedule as a fair and satisfactory scheme.

Although victory has favoured the cause of the intended victims of a *coup de main* in these two instances, there is little doubt that, despite the object lessons of Dover and Perth, other attempts will be made to upset the Schedule, either openly or in ways that are less obvious though none the less dangerous. In every case, it is the firm intention of the E.P.E.A. to resist by every means in its power. It is determined to maintain unimpaired the "Bill of Rights" which has received the approval of both sides of the National Joint Board, and which, with very few exceptions, has been accepted by every undertaking in the Kingdom to which it is applicable.

A significant feature of the attacks made on the Schedule has been the complete disregard shown by the aggressors for the machinery erected for dealing with all matters pertaining to the salaries and working conditions of technical engineers, that is, the District Joint Boards. It is no secret that the E.P.E.A. pins its faith to Whitleyism as the best existing means for the preserving of peace and the securing of justice in industry. Whether Whitleyism will be the ultimate solution of the problem is a matter for the future, but until a better system is devised, the Association will refuse to countenance any attempt to short-circuit or to ignore the established tribunals for the consideration and settlement of grievances and disputes. It consistently adheres to constitutional procedure itself, and it expects others who are parties to and are represented on the Joint Boards to do likewise.

In the event of an undertaking desiring a variation in the interpretation of the Schedule owing to particular circumstances, its proper course is to lay its views before the D.J.B., when due weight will be given to any arguments brought forward and a fair decision arrived at after careful consideration of the case. The Board exists for that purpose. To resort to arbitrary methods and without reference to the body constituted for the deciding of precisely such cases is to revert to the chaotic conditions prevalent in the bad old days before the idea of Whitleyism had taken coherent form.

It is to be hoped—though one must be careful not to be oversanguine—that the exemplary lessons of Dover and Perth have been duly noted and taken to heart by all other undertakings, and that there will be no further attempts at similar high-handed and unconstitutional action.

Should such unfortunately occur, the E.P.E.A. will be found no more disposed to take it lying down than it has already shown itself, for it is after all very much like the cat, which is " un animal méchant; quand on l'attaque, il se défend."

W. Arthur Jones,
General Secretary,
Electrical Power Engineers' Association.

London, S.W.1.
August 19th, 1921.

The Electrical Trades Union and Non-Union Labour.

It is amusing to read in your current issue of the latest edict uttered by the London Executive of the Electrical Trades Union, placing a ban upon the connecting up of installations in buildings wherein the employés are not trade unionists.

Do they really think the whole community is going to bow down to them and obey their laws? In these days of slack trade and widespread unemployment, it is no time to clog the wheels of industry and hamper trade as these " dog in the manger " followers are attempting to do.

The obvious solution to the present dilemma would be for Stepney Corporation's engineer to order his men to make the necessary connections, and should the " chosen few " refuse to obey orders, there are plenty of non-union men out of work who will be only too glad to take their places.

Non-Union.

August 15th, 1921.

POWER FACTOR.—I.

By E. W. DOREY, A.M.I.E.E.

Increasing attention is being given by the engineers of supply undertakings to the improvement of power factor, but until such time as the supply undertakings in general adopt a tariff which incorporates some form of charge on a kVA demand basis the installation of apparatus for the improvement of power factor will not be given the attention which it merits.

It is a generally accepted fact that the power factor of the load is the concern of the consumer, and is controlled by the consumer, therefore logically the consumer should improve the power factor, but in turn should get some benefit by way of reduction of the bill for improving the power factor, and thereby reducing the kVA demand. Again, it is obviously the correct thing to effect the improvement at the source of the trouble, viz., the consumer's load.

The supply of cheap electrical energy is vital to the interests of this country, and to obtain this we must have the maximum of economy in working. The linking-up of power stations and the construction of super-stations are all working to this end, but it is doubtful whether sufficient consideration is being given to the question of low power factor. The maximum economy of working cannot be obtained unless the general power factor of the system is high.

The power factor of the station may be high—even as high as unity—but it does not follow that, so far as power factor is concerned, the maximum economy is being obtained, and to illustrate this point a simple example will be taken as follows:—

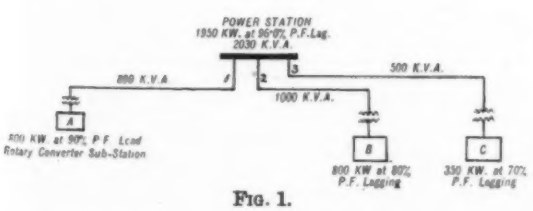


Fig. 1.

It will be seen that the load of the power station in both cases is identical, but with conditions as in fig. 1, although the power factor of the station is 96 per cent. lagging, maximum economy, so far as distribution is concerned, is by no means being obtained.

By the installation of, say, static condensers at sub-stations " B " and " C " to improve the power factor at these points to 89.6 per cent. lagging, and by running the rotary converter sub-station " A " at unity power factor instead of 90 per cent. leading (with reduced excitation losses), we get precisely the same result at the power station, but with obviously improved results on the distribution network as follows:—

	As fig. 1. kVA.	As fig. 2. kV.A.	Saving. kVA.
Load on power-station ...	2,030	2,030	—
Load on feeder (1)	890	800	90
Load on feeder (2)	1,000	893	107
Load on feeder (3)	500	391	109
Totals: 1, 2 and 3 ...	2,390	2,084	306

If it be assumed that the system as figs. 1 and 2 is to be laid out to meet the respective conditions, then fig. 2 would show the following saving against fig. 1:—

	Reduction.
Power-station switchgear capacity ...	306 kVA.
Distribution feeder capacity	
Sub-station transformer capacity ...	

To effect the improvement of power factor stated, assuming a frequency of 50 cycles and a normal medium pressure of supply would cost about £1,800, or in other words, the condensers would cost the equivalent of approximately £6 per kVA of reduction in load. Again, there would be a very considerable saving in the running costs due to reduction in excitation losses of the rotary converter sub-station. (It is assumed that the losses in the mains would remain the same, as the section would be reduced in fig. 2.)

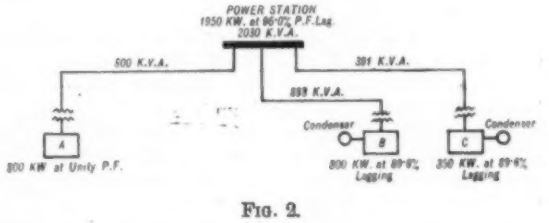


Fig. 2.

An expenditure of £6 per kVA for power-station switchgear, feeder mains, sub-station transformers, and sub-station switchgear will not carry very far, and although an apparently unpromising example has been

chosen, it will be seen that the improvement of power factor would undoubtedly result in improved overa'l economy both as to capital costs and running costs.

It is obviously impossible to disassociate capital costs and running costs, and power factor has an important bearing on both. The power factor meter at the power station gives no indication whatever as to the conditions on the distribution network, as will be seen from the example given above. It is essential, therefore, that to ensure a supply of electrical energy at a low figure the problem of power factor be dealt with on a sound basis by keeping the power factor of the consumer's load at as high a figure as is reasonably possible.

A HIGH-RESISTANCE BREAK TEST OF SUBMARINE CABLE.

By J. RYMER-JONES.

In *re* "high-resistance break test," based on both the measured resistance up to, and through, the break in the cable conductor, in combination with the observed *capacity*, the Rymer-Jones means of easily perfecting the balance adds considerably to the value of a dead-beat marine galvanometer for localising, at sea, the position of a high-resistance break, by the Rymer-Jones test; because it will be recognised that the better the coil is *balanced*, the more steady and comparable will be the capacity *throws* observed while the ship is pitching and rolling.*

In saying this, the writer wishes it to be understood that observations made from the shore (where everything is quite steady) with a loose-wire suspension; and where the galvanometer can be made much more sensitive; and where, moreover, the consideration of *balancing* does not come in, will always be much more exact because the swing is comparatively slow, and therefore more easily read. On the other hand, on board ship the suspension must necessarily be very taut, and the throws comparatively quick and abrupt; so unless they are tolerably *regular* and the limit of each throw is, therefore, approximately known (*i.e.*, supposing that the fault under test does not vary much) the true value of the throw cannot be read with absolute certainty; and the number of reliable throws obtainable in a given time is considerably lessened.

Moreover, an ordinary "Kelvin" *astatic* galvanometer, whose coils can be connected differentially, is very suitable for use *on shore;* for, although not *dead-beat* when measuring the conductor part of the circuit, it is very suitable for observing *capacity* throws. Indeed, it was with such an astatic galvanometer that the writer first made his tests when localising the positions of breaks, of very high and differing resistances, which gave the remarkably exact results as published in the Electrical Review of June 24th, 31st, and August 7th and 14th, 1908, and reprinted in pamphlet form.

At the end of the same pamphlet will also be found the effect of *retardation* in reducing the *capacity* throws below their true value, when observed through long lengths of cable extending from the testing station to the broken end, which retardation has to be taken into account (according to the kind of galvanometer employed) when evaluating, from the observed readings, the distance of the *high resistance break*.

As the two "balancing" wires are at right angles to each other, and both pass exactly through the mechanical centre-line of suspension, altering the position of the *threaded wire*, to equalise the weights, say, at the back and front of the coil, should not make any change in the degree of balance brought about by previously adjusting the position of the wire intended to equilibrate the weights of the two *sides* of the coil. Consequently, one adjustment can be made immediately after the other. In other words, the two adjustments are quite independent of one another in their effect on the existing degree of balance. It is on this fact that the extreme simplicity and success of the balancing process depends; time is saved, and risk of damaging the coils, by unnecessarily frequent handlings, is obviated.

* See Rymer-Jones' galvanometer and particulars of suspending, and balancing, the coil as explained in Patent Specifications No. 108,649, 19/3/17; and No. 117,038, 7/1/18.

The galvanometer coils can be connected in *series* or *differentially*.

HYDRO-ELECTRIC POWER IN FRANCE.

Prospective Water-power Developments.

All the water power resources in France which are available for use in connection with the production of electricity are to be mapped and harnessed, and rendered serviceable where lacking and where it has hitherto been, and still is, furnished by steam power, or in certain cases even imported. This is the broad scheme of the Administration, the present situation being set forth in the accompanying map, fig. 1, on which the areas in which hydro-electric energy is generated are shown in circles (the sizes of which are proportional to those of the installations), and the areas in which electricity is generated by steam power are indicated by squares, similarly dimensioned.

Arranged according to size, the existing water-power plant is as follows: In the south-east, a group of 2,500,000 h.p.; in the south-west, one of 800,000 h.p.; in the middle, a group of 700,000 h.p.; and in the east, a group of 500,000 h.p.

The steam-driven plant is distributed throughout the whole of the north-west, with 600,000 h.p. at Paris, 300,000 h.p. in the coal districts of Arras, 200,000 h.p. at Rouen,

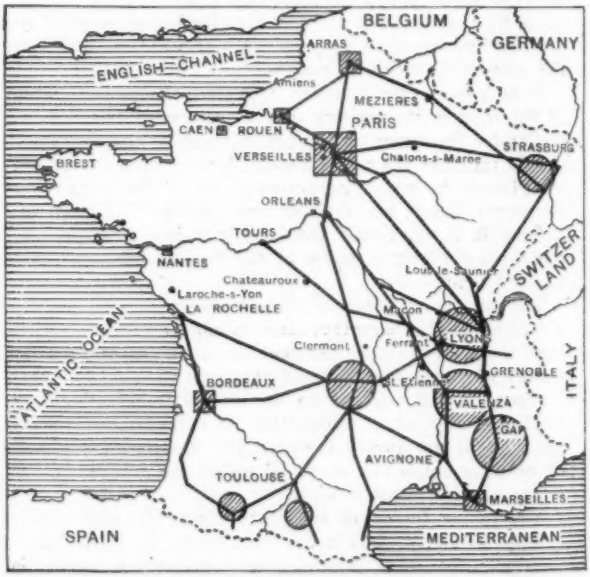


Fig. 1.—Centres of Production of Electricity in France and their Interlinking Network.

100,000 h.p. at Caen, 100,000 h.p. at Brest, 100,000 h.p. at Nantes, and, by way of exception, 300,000 h.p. at Marseilles. The network of lines in the Government's programme will link up all these generating stations, in order to obtain the systematic utilisation of the whole of the water and steam-power resources in the centres of consumption, taking account at the same time of developments under way and the idea of securing the utmost continuity in working. The programme also shows how it is possible, in the ordinary way, to convert the steam stations into reserves and stand-bys, as well as some of the water stations.

As a principal result, the consummation of the network will tend to bring to zones wholly unprovided with energy—and Paris is the biggest centre of consumption of the whole country—the energy available in the Alps and along the course of the Rhône, besides utilising, within the bounds of practical economy, energy generated by steam-driven plant in coalfields or by local waterfalls. Thus Paris, which is 165 km. from Arras, and about 500 km. from the principal south-eastern centre of water-power production, may be served

from two quarters, according to the economic conditions of production of the energy. The scheme does not contemplate setting up an entirely new distribution network, but the provision of suitable section posts for the reinforcing of existing networks serving consuming areas, with bold offshoots to the right or left. French technical experts thus intend, on one hand, to facilitate the progressive extension of the networks already in existence in all districts contemporaneously; and, on the other hand, avoid the difficulty of the parallel operation of power stations at great distances apart, and also general dislocation in cases of overload at any point in the network. There will thus be many high-pressure networks and many at lower pressures, but the dangers from the crossing of mains will be suitably guarded against. The scheme for the utilisation of the power recoverable from the Rhône, which is typical of the rest, is arranged in six groups, each with its respective generating stations, as portions (fig. 2).

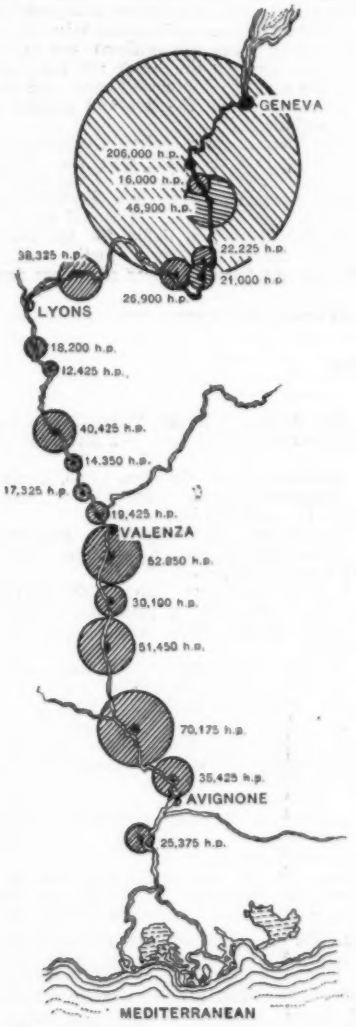


Fig. 2.—Hydro-electric Power Recovered from the Rhône.

In the French portion of this river some 770,000 h.p. is obtained, of which more than 260,000 h.p. is got in the higher part; and over 100,000 h.p. in the Lyons and neighbouring districts. The first group, from the Swiss border to the Canale Savière, has three generating stations—Genissiat, 206,000 h.p. capacity; Seyssel, 16,000 h.p.; Bourein, 46,900 h.p., or a total of 268,900 h.p. The second group, from the Canale Sacière to Saône, Belley No. 1, 22,225 h.p.; Belley No. 2, 21,000 h.p., and Belley No. 3, 26,900 h.p., or a total of 70,125 h.p. The third group consists of one generating station, Villette, of 38,325 h.p. capacity, and embraces the district of Lyons. The fourth group, from Saône to the Isère, has five generating stations—Ternay, 18,200 h.p.; Vienne, 12,425 h.p.; St. Rambert, 40,425 h.p.; St. Vallier, 14,350 h.p., and Tournon, 17,325 h.p., or a total of 102,722 h.p. The fifth group, from the Isère to Gardon, has six generating stations—La Roche du Gluc, 19,425 h.p.; Valence, 58,850 h.p.; Logis Neuf, 30,100; Montelimar, 51,450; Mondragon, 70,175; Sorgues, 35,325, a toal of 265,325 h.p. The sixth group, from Gardon to the sea, has one station, Aramon, 25,375 h.p. The grand total of the Rhône is thus 770,775 h.p.

The technical method of division and crossing of the general network will help the carrying out of the political idea of leaving the production of electricity to private initiative, stimulated solely by actual local requirements for industrial purposes, and controlled by the principles of strict economy. With neither industrial nor private initiative forthcoming to undertake the erection of generating plants, then the State will step in, as it has done in the war-devastated areas. The amount of coal that the scheme will save will be very large.—*Ingegneria Italiana.*

STATUTORY COMPANIES AND THE LAW OF NUISANCE.

From a Legal Contributor.

A recent case in the King's Bench Division will serve to remind those who carry on manufacturing processes in large cities that they are exposed to actions for nuisance. In the case in question, it was alleged that the defendants, a gas company, who had a coal conveyor at Wapping, had caused a nuisance in the neighbourhood by allowing coal dust to escape from their conveyor. They pleaded, in extenuation, that they did their best to cope with the nuisance and to keep the coal dust within its proper limits; that the air of Wapping could not be expected to be like that of a breezy moor. It was also urged that they had carried on business on the site where their works now stand continuously ever since the year 1823. One other defence was also put forward. It was suggested that the defendants were protected by the Public Authorities Protection Act, 1893. But it was in vain! Mr. Justice Shearman held that a nuisance had been caused and that the defendants were liable to pay damages.

This case appears to point a moral for electric lighting supply authorities who necessarily carry on the production of electricity in crowded areas. If, in the course of their operations they create a nuisance, are they liable, and, if so, to what extent? They are not excused, by statute, if they cause a nuisance. Their liability is the same as that of an ordinary manufacturer.

There is one plea advanced on behalf of the defendants in the case just mentioned which is often put forward in these cases—namely, that the defendants had been in the same place and done the same thing for a number of years. But this is no answer to an action for nuisance. If Brown builds a house next door to Jones's factory, from which nasty odours, or disagreeable noises are emitted, it is no answer to an action for nuisance for Jones to say that Brown knew what he was in for when he came to the district. Similarly those who complained of the coal dust from this Wapping gas works. But there are certain peculiar forms of action for nuisance to which electricity authorities are exposed, and "product" which is generated at the station may do damage to premises and property far away. For example, side by side along many of the principal streets in the City of London there are laid electric mains, gas pipes, water pipes, and mains for the convevance of water under hydraulic pressure. When subsidences take place forces are let loose which begin to react one upon the other. Who is liable? Damage is sometimes done by the bursting of a gas main; the effusion of gas into an inspection chamber, and the inevitable explosion. Is the gas company liable?

We may refer to the case of the Charing Cross, West End and City Electric Supply Co. *v.* London Hydraulic Power Co., which was decided in 1913. The Charing Cross Co. supply electricity in the City of London under a provisional order which authorises them to place their cables under the surface of the streets. They brought an action against the London Hydraulic Power Co., who have by statute the right to place in the streets of the City of London mains containing water at high pressure used to supply hydraulic power, and alleging that water escaping from these mains damaged their cables, and that it either escaped through the defendants' negligence, or, having escaped, was a nuisance doing them damage, and they claimed damages. The defendants replied that they were not negligent, and that in the absence of negligence they were not liable, especially as they contended that the fractures of their mains were caused by subsidences due to the laying of the plaintiffs' pipes. This case came before Mr. Justice Scrutton (as he then was). In giving judgment, on July 5th, 1913, he said that the hydraulic company had been guilty of no negligence either in their system or its working. This finding must, no doubt, have been gratifying to the hydraulic company; but it must have been a little disconcerting to find that this favourable opinion notwithstanding, his Lordship felt bound to decide against them!

Upon what principle did he so decide? It was long ago declared that any man who brings anything on to his land which may escape and do damage to his neighbours' property, must keep it there at his peril, and the very fact of its escaping is, *prima facie*, evidence of negligence. This principle was settled in relation to water in the case of Fletcher *v.* Rylands (1868. L.R. 3 H.L.C. 330). There the defendant had made an artificial lake on his estate. The water broke through and flooded certain shafts in a mine belonging to

the plaintiff. The defendant was held liable. Mr. Justice Blackburn stated the principle to be that anyone who brings on to his property something which is not naturally there, harmless to others so long as it is confined to his own property, but which he knows to be mischievous, if it gets on his neighbour's land, must keep it at his peril, "and ought to be obliged to make good the damage which ensues if he does not succeed in confining it to his own property." It was the very essence of this decision that the plaintiff was injured through no fault of his own. Quoting Mr. Justice Blackburn, Lord Cairns, in giving judgment in the highest legal tribunal in England—the House of Lords—said, at page 340 of the report: "The person whose grass or corn is beaten down by the escaping cattle of his neighbour, or whose mine is flooded by the water from his neighbour's reservoir, or whose cellar is invaded by the filth from his neighbour's privy, or whose habitation is made unhealthy by the fumes and noisome vapours of his neighbour's alkali works, is damnified without any fault of his own."

The learned judge might have had some difficulty in applying the doctrine of Rylands *v.* Fletcher to water under hydraulic pressure had it not been for the fact that the principle had already been followed in relation to electricity.

In the case of Midwood & Co. *v.* Manchester Corporation (1905), 2 K.B. 597, the defendant Corporation were empowered to supply electric energy for lighting purposes in the City of Manchester, and were accordingly empowered to lay down mains under the streets, and were bound to give a supply to persons requiring it. Clause 70 of the statute under which they worked provided that nothing in the order should exonerate the undertakers from any indictment, action, or other proceeding for nuisance in the event of any nuisance being caused by them. A leakage of electricity occurred in one of the mains which fused the wire, and the fusing of the wire caused the compound in which the mains were laid to be volatilised. Large quantities of gas were thus generated which caused an explosion and set fire to the plaintiffs' house. It was held that apart from any question of negligence, the Corporation were liable for a nuisance by virtue of clause 70 *supra*. The judge came to this conclusion with evident reluctance, and gave a distinct hint that the day may come when the use of the highway underground for pipes, cables, and the like will be looked upon as ordinary normal use. Thus he said towards the end of his judgment: "But for Midwood's case, I should have some doubt whether the defendant was not protected as a person using the road, in the ordinary way, and therefore not liable to persons damaged by the user unless his negligence was proved on the lines of such cases as Blake *v.* Woolf (1898) 2 Q.B. 426 and the authorities cited therein. For I think it is now an ordinary use of a road to carry mains for water, ordinary or hydraulic, gas, and electricity underneath it, and that there is something to be said for the view that all these co-licensees take the road subject to the risks arising from the ordinary use of the mains of their co-users, so long as the latter are not negligent. But this defence was open in Midwood's case, and was not sanctioned, and Section 17 of the Act and similar clauses may be meant to exclude it."

In the result, therefore, the hydraulic company have brought a dangerous thing into the road, and the dangerous thing has escaped through the subsidence of the soil. This is just how the water escaped in Rylands *v.* Fletcher (*supra*) where the defendant was held liable. It would seem that in this case also the defendants are liable for the amount claimed with costs. The same measure of justice will apply to the plaintiffs if their electricity escapes and does damage.

BUSINESS NOTES.

Bankruptcy Proceedings.—T. Hyde, electrician, 180, London Road, Croydon.—Receiving order made August 16th on debtor's own petition. First meeting August 26th at 132, York Road, S.E. Public examination October 20th at the County Court, Croydon.

A. Lord, electrical contractor, Burnley.—Last day for proofs for dividend August 31st. Trustee, Mr. C. H. Plant, O.R., 13, Winckley Street, Preston.

A. E. Dickinson (Crown Electrical Co.), electrical engineer and contractor, Leeds.—August 31st is the last day for proofs for dividend. Trustee, Mr. H. C. Bowling, O.R., 24, Bond Street, Leeds.

A. Kershaw and C. H. Wood (Kershaw & Wood), electrical engineers and merchants, Dewsbury.—First and final dividend of 4s. in the £, payable at 155, Norfolk Street, Sheffield.

W. Hedgecox, electrical engineer, 121, Salop Street, Wolverhampton.—First and final dividend of 1¼d. in the £, payable August 29th at the Official Receiver's Office, 30, Lichfield Street, Wolverhampton.

Dissolution of Partnership.—Maurice & Coward, 139, Oxford Street, London, W.1.—Messrs. C. B. Maurice and H. W. Coward have dissolved partnership from 6th inst. The business will be carried on under the title of Coward & Co. Debts will be attended to by Mr. Coward.

Company Liquidation.—F. Husband, Ltd.—Meeting called for September 19th at 119, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidator, Mr. W. A. J. Osborne.

Receiver Appointed.—F. J. Shenton & Co., Ltd.—Receiver and manager, Mr. H. A. Allison, Kennans House, Crown Court, Cheapside, E.C., appointed August 10th by order of the Court.

Deed of Assignment.—A. Gray (Gray's Electrical Co.), 9, Denmark Street, Charing Cross Road, W.C. 2. Particulars of claims must be sent to the trustee (Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement) by September 12th.

Trade Announcement.—With reference to a recent announcement, the appointment of the British Central Electrical Co., Ltd., as agents for Messrs. Richardsons, Westgarth & Co., Ltd., relates only to London, Midlands, and South Coast.

Catalogues and Lists.—The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough, Leicestershire.—A well-produced brochure dealing with the construction and capabilities of Brush-Ljungström turbines and alternators. Many illustrations of details are given, as well as detail drawings.

The D.P. Battery Co., Ltd., 11, Victoria Street, S.W. 1.—A folder illustrating and describing a specific gravity tester for all types of enclosed accumulators.

Dictograph Telephones, Ltd., Aurelia Road, Mitcham Road, Croydon.—A descriptive pamphlet of a new calling system for factories and offices.

Messrs. Rayner & Heald., Ltd., Duke Street, Derby.—Stock list of 2- and 3-phase induction motors of from 1 to 45 b.h.p.—slip-ring and squirrel-cage types.

Messrs. Grey & Co., 7, Market Place, Oxford Circus, W.1.—A pamphlet advertising "Platact"—a metal for electrical contacts.

Simplex Conduits, Ltd., Garrison Lane, Birmingham.—An illustrated pamphlet dealing with the "Terra-Grip" continuity system for conduit installations.

Messrs. Belling & Co., Derby Road, Edmonton, N.18.—A number of illustrated pamphlets dealing with "Belling" cooking and heating appliances.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, E.C.1.—Catalogue No. 151, a price list of switches, fuses, adaptors, ceiling roses, flexible wires, cables and other electrical accessories.

Messrs. F. A. Wilkinson & Partners, Ltd., Hatfield, Herts.—A small brochure describing automatic high-speed wind dynamos (*vide* Elec. Rev., April 29th, 1921, p. 545).

Messrs. Anderson, Boyes & Co., Ltd., Flemington Electrical Works, Motherwell.—A profusely-illustrated catalogue of mining type ironclad switchgear, lighting fittings, &c., of compact and robust design.

The New Rotoplunge Pump Co., Ltd., 24, Broadway, S.W.1.—A number of illustrated and priced lists dealing with "Rotoplunge" pumps and pumping sets for hand-operation and various types of drive.

Metropolitan-Vickers Electrical Co., Ltd., 20, Brazennose Street, Manchester.—Circular No. 1790/1, an illustrated description of motor equipments for main rolling mill drives.

For Sale.—By direction of the Disposal Board, Messrs. King & Chasemore will sell by auction on September 22nd, at Southwick, Sussex, electrical plant and machinery, including motors, rotary converters, electric winches, cranes, &c.

Aldershot Urban District Council Electricity Department invites offers for one 4-cylinder, 135-kW Carel-Peebles Diesel set.

By direction of the Disposal Board, Messrs. Geering and Colyer will sell by auction, at Harty Ferry Factory, Faversham, on September 14th and 15th, electrical equipment consisting of electric generators, motors, dynamos, lifts, pumps, &c., and on September 15th and following days, at the Royal Dockyard, Woolwich, Messrs. L. Farmer & Sons will offer by auction plant, machinery, electrical equipment, telegraph, telephone, and wireless stores. Full particulars are given in our advertisement columns in this issue.

By order of the Disposal and Liquidation Commission, Messrs. Fuller, Horsey, Sons & Cassell will offer by auction on September 20th, at Greenwich, chemical plant and machinery, &c.

Fusion of Swedish Telephone Manufacturing Concerns.—According to *Svensk Handelstidningen*, the Cedergren Co. will hold an extraordinary meeting on August 30th regarding the fusion with the L.M. Ericsson Co. at which it will be proposed that the agreement be accepted. Although the agreement was rejected on June 17th, it is stated that many of the opposing shareholders have changed their opinions regarding the real position of the L.M. Ericsson Co. If the agreement is approved one share of the Cedergren Co. will probably be exchanged for each ten shares in the Ericsson concern.—*Reuter's Trade Service* (Stockholm).

Miners' Conference and F.B.I.—We have received the following communication from the Federation of British Industries:—

"At the Miners' Conference at Llandudno on Friday last, Mr. Gavan Duffy was reported generally in the Press as having said that the Federation of British Industries had 376 of their members in the House of Commons—this group, in his opinion, possessing complete control over the Government. Statements of this kind have been made by responsible labour leaders in every part of the country, though without the slightest foundation. It seems necessary, therefore, to correct an error which such a large number of Labour publicists are making. The facts can be clearly stated as follows:—

"The Federation of British Industries takes no part in politics whatever, and has never at any time supported or worked for Parliamentary candidates.

"It happens in the ordinary course of events that there are between 70 and 80 Members of Parliament who are connected with firms which are members of the Federation, but in no single instance can it be said that the Federation had any part in these being elected."

International Exhibition in Brazil Next Year.—The Centenary of the Independence of Brazil will be celebrated at Rio de Janeiro in the autumn of next year. In connection with the celebrations there will be an extensive Brazilian National Exhibition, and also an International Exhibition. A number of nations have been invited to participate, and many of them, it is understood, have already accepted the invitation. The celebrations will be on a magnificent scale, and will include an international naval display. It is quite certain that it will be largely attended by the peoples of all the South American States, and should afford an unusual opportunity for those interested in trade with Brazil to develop their business. The social atmosphere in Brazil is said to be most favourable towards the British Empire. The friendship is the result of long association and the vast British interests which have been developed in Brazil over a long period of years, notably in connection with their railways. It is calculated at the present time that there is nearly 300 millions of British capital invested in the country which at the same time is being subjected to intensive propaganda by rival nations. It is probable that official participation by the Empire will be decided upon at an early date. Owing to the limitations of space available for the erection of national pavilions such participation fortunately need not entail very much expenditure, but while it affords opportunities for collective exhibits on behalf of the various nations of the Empire, and of those manufacturers and commercial bodies most intimately interested, it is insufficient to provide space within the national pavilion for individual exhibits of British firms. It is understood, however, that space for these is available to the extent of some 100,000 superficial feet on adjoining quays, and that it may be found possible to provide space within the city itself for exhibits to be made. In the opinion of the British Chamber of Commerce in Brazil the opportunity afforded to British manufacturers, not only of the United Kingdom but of the whole Empire, is a unique one, and should not be lost sight of. The exhibition will open some time early in September, 1922, and it is hoped that full information may be available at an early date.

New French Companies.—A new company has lately been formed in Paris (57, Rue Pierre Charron) with a capital of 38,000,000 fr., and the title La Société Union Hydro-Electrique U.H.E.

There has been formed at Grenoble (27, Rue de Turenne) the Société Hydro-electrique de la Basse Romanche with the object of developing waterfalls in the Department of the Isère, and more especially those on the right bank of the Romanche. The construction of one or several generating works is in contemplation. The capital of the company is 1,000,000 fr. in 500 shares.

At Levallois-Perret (Seine) has been formed into a company the Etablissements Paul Gadot with a capital of 2,600,000 fr. in 500 shares, 1,400 of which are allotted to M. Bertrand Parouty, as liquidator of the former concern of the same name. The company's operations are the manufacture, sale, and installation of electrical apparatus of all kinds.

The Engineering Wages Ballot.—The results in the ballot vote amongst the engineering and kindred unions on the proposed wages reduction have been officially issued to members as follows:—

	In favour.	Against.
Amalgamated Engineering Unions ...	71,862	63,624
Affiliated Societies	43,016	21,394
National Union of Foundry Workers ...	17,969	5,241
Societies affiliated to Federation of General Workers	42,278	18,710
	175,145	108,969

Majority in favour of acceptance, 66,176.—*Daily Dispatch.*

Book Notices.—"Some Notes on the Application of Oil Fuel to Steam Boilers, July, 1921." (11 pp.) Manchester: Taylor, Garnett, Evans & Co. (for the Manchester Steam Users' Association).—This pamphlet describes in some detail the advantages and disadvantages of the adaptation of coal-fired boilers to oil fuel.

A new arrangement has been adopted in the 1921 issue of the *Electrician* annual tables of electricity undertakings (London: Benn Bros. Price 10s. net). Instead of the tabular form, the particulars of each undertaking are given separately; there is much to be said for this system, as tracing details across two pages often leads to errors. The details of generating and steam-raising plant, omitted during the war period, have been restored. Some information regarding oil-burning apparatus installed recently by several undertakings also appears.

"The Electrical Power Engineer," Vol. III, No. 2, August, 1921. Price 4d.—Containing an instalment of a paper "Factors Affecting Power Station Efficiency," by J. N. Waite, A.M.I.E.E., and notes on recent happenings in the profession.

"The Mining Electrical Engineer," Vol. II, No. 11, August, 1921. Manchester: Association of Mining Electrical Engineers.—The special articles include: "Early Electric Coal-Cutters," by E. Kilburn Scott; "Submersible Electric Motors for Mines' Pumps," by A. J. Ramsey; and "Tests on a Large Turbo-alternator," by W. D. Wheeler.

"*Journal* of the American Institute of Electrical Engineers," Vol. XL, No. 8, August, 1921. New York: The Institute.—The following papers are included: "Electric Propulsion of Ships," by W. E. Thau; "On the Equivalence of the Two Theories of the Single-phase Induction Motor," by V. Karapetoff; "Voltage Regulation and Insulation for Large-power, Long-distance Transmission Systems," by F. G. Baum; "Dimensions and Output," by Lawrence E. Widmark; "Advances in the Art of Waterwheel Design and Settings," by W. M. White; and "Electrical Terminal Facilities," by C. S. McDowell.

"*Financial Times* Income Tax Guide." By H. W. Palmer. 1921 edition. London: *Financial Times*. Price 1s. net.

"Electrical Transmission of Energy." By W. M. Thornton. Pp. xii+116, figs. 49. London: Sir I. Pitman & Sons. Price 2s. 6d. net.

Holidays.—Messrs. E. Brook, Ltd., Empress Works, Huddersfield, announce that their works and offices will be closed from September 3rd to September 10th inclusive, for the annual holidays and stocktaking.

Electric Locomotives for Japan.—The Westinghouse Electric International Co. has received from the Imperial Government of Japan an order for two electric freight locomotives to be used in service in the neighbourhood of Tokio. These locomotives, which will weigh 62 tons and have a capacity of 1,000 h.p. each, will operate on the 1,500-volt direct-current system.—*Reuter's Trade Service* (New York).

The Engineering and Steel Trades.—Authorities speak of an approaching revival of the Sheffield steel trade.

The new steel works of Messrs. Baldwin at Port Talbot will be opened shortly. Orders for 17,000 tons of rails are said to have been received.

At Lincoln the position of the engineering trade has already improved, a number of important export orders for wagons, locomotives, &c., having been booked.

There is also renewed activity in connection with the blast furnaces of the Cleveland district.

Electrical Supplies in South Africa.—The *South African Mining and Engineering Journal* (Johannesburg), in its issue of July 30th, says: Trading in electrical goods in town and country remains pretty much the same; little activity is being shown generally, and apart from the usual repair work there is not much life in this section. Nor does the acknowledged inadequacy of the present power station, together with the very subdued scale of operations in the building trade, justify any promised improvement in the immediate future. As regards lamp prices, these are declining, and have already gone down about 10 per cent. Other lines remain without quotable change. Electrical wares from Britain are arriving steadily, with no present alteration in prices, but the tendency in consequence of the termination of the coal strike is towards lower levels, which may be felt, it is thought, sometime next month. Continental goods show no material change, but are, as previously pointed out, coming on to the market at prices much below British manufactures.

The National Bank of South Africa reports that German competition in South Africa has restarted in electrical machinery and electrical articles. Continental manufactures, it is said, are being offered at 20 per cent. less than English prices, and in many cases 50 per cent. cheaper, but the business in the market is inconsiderable as building trade operations are depressed.

An Indian Steel Contract.—According to a Bombay Press dispatch (Exchange Telegraph Co.) appearing in the London papers the fall in prices of steel is reflected in the tender for the supply and laying of 105 miles of water main in Bombay. The lowest tender was that of Messrs. Braithwaite, of Calcutta, which was approximately 256 lakhs of rupees (£1,640,000). The fact that the steel to be used is English, makes the acceptance of the tender of special interest. It was expected that American steel makers would be in a position to quote competitive rates, but the four tenders received varied between 377 lakhs (£2,520,000) and 609 lakhs (£4,050,000). The successful tenderers are said to be backed by Dorman, Long & Co. The next lowest tender, that of Sir John Jackson, was 350 lakhs (£2,333,000). The dispatch adds that "the result of the invitation of tenders is regarded as a triumph for English manufacturers."

Czecho-Slovakia.—The Customs Tariff.—Owing to the revision of the various Customs agreements between Czecho-Slovakia and other countries all goods imported into Czecho-Slovakia will henceforth be subject to the general Customs tariff.—*Reuter's Trade Service* (Prague).

Prices Reduced.—The Automatic Telephone Manufacturing Co., Ltd., of Liverpool, has recently made considerable reductions in the prices of its "Xcel" heating and cooking appliances.

American Steel Workers' Wages.—The United States Steel Corporation announces that in view of the low selling price prevailing for steel, another reduction will be made in wages for day labour from 37 cents to 30 cents an hour.—*Reuter's Trade Service* (New York).

Syria.—In the course of a report on the trade of Syria (with special reference to Beyrout) for 1920, H.M. Consul-General at Beyrout mentions that two of the three public utility undertakings, the Tramways Co. and the Electric Light Co., give cause for complaint. The former's service is inefficient, the rolling stock requires renovation and the lines relaying. The Electric Light Co.'s power station is inadequate, so that the lighting of both of the streets and of private houses is very poor. The Gas Co., never a very prosperous concern, has ceased to function. It has just been invited to carry out the terms of its concession within six months, failing which it will lose it.

There is nothing definite to report as to the project for building a port at Alexandretta, but it will be realised in course of time. There are some schemes under discussion for obtaining electric power from streams in the Lebanon. A beginning has been made with one such scheme at the Nahr Ibrahim, north of Beyrout, but it has made little progress.

There is a vast amount of reconstruction and development to be done in Syria by the French to whom the mandate has been given. The difficulties are great and the complete reorganisation of the country will entail a large outlay of money. With the terms of the mandate not yet definitely approved, and the settlement of the country not yet completely effected, no striking developments can at once be expected, but progress if slow will undoubtedly be sure.

Leeds Tramways.—The seventeenth annual sports festival of the Leeds Tramways Employés' Social and Athletic Club took place at Headingley on August 17th, in the presence of a gathering of between two and three thousand spectators. The prize list amounted to about £120, and the events—for which there were many entries—included running, walking, and cycling races, most of which were open to entrants from other towns' tramway services. Music was provided by the Leeds Tramways Band. The Lord Mayor and Lady Mayoress and many members of the City Council and Tramways Committee were present.

Miners' Unions.—The National Enginemen, Stokers' and Electrical Trades Union has applied for affiliation to the South Wales and Monmouthshire Mechanical and Surface Workers' Union, as the Colliery Enginemen and Stokers' Association has been renamed on its secession from the South Wales Miners' Federation.

Wages in the Contracting Industry.—A ballot vote is being taken of members of the Electrical Trades Union as to the acceptance or otherwise of a sliding-scale basis of remuneration for members employed on contracting work. The index figure of 150 will represent 2s. 3d. per hour, and for each variation of three points in the cost of living a corresponding increase or reduction in wages will be made, if an affirmative vote is recorded.—*Daily Herald.*

American Steel Production.—The figures relating to electric furnace steel for last year are particularly interesting as showing the marked advance this process has made in the United States. During the year a total of 155,196 tons of electric steel was cast, as compared with 111,510 tons for the previous year and 108,296 tons during 1918. An increase of 43,686 tons is thus shown, representing an improvement of 39.18 per cent. on the last year's figures, and it may be noted that the total electric steel-casting production during 1920 was only a few tons short of the total output of the United States to the beginning of 1918, and was actually nearly 42 per cent. of the total electric steel production of the States up to the end of 1919. It may be noted, further, that the output of electric steel last year was only 5,648 tons less than the record production of Bessemer, which was during 1918, and 50,216 tons in excess of the 1920 Bessemer figures.—*The Times Trade Supplement.*

German Pre-war Debts.—The attention of British subjects resident in this country who have pre-war debts owing to them from branches outside Germany of German undertakings whose head office is in Germany, is drawn to the fact that apart from their remedy against the branch, they may be entitled to claim payment alternatively from the head office through the Enemy Debts Clearing Office. In the event of there being any doubt as to recovery of such debts from the branch, British creditors will be well advised to file a claim against the head office with the Enemy Debts Clearing Office, Cornwall House, London, S.E. 1. It is essential, however, that any such claims should be received by the Clearing Office before September 30th.

Agency Arrangements in Constantinople.—Despite the depression and uncertainty which mark conditions in Constantinople, there are points worth examination in the report which the Department of Overseas Trade has just issued regarding trade and industry in Turkey.

Many of Britain's competitors have either resumed activities or paved the way for their resumption. For example, American firms and corporations which were totally unknown in Turkey in pre-war days have now established branches or have appointed agents. Italian competition, too, has to be met, as elsewhere in the Orient, owing to the advantage of geographical position, combined with an efficient merchant fleet.

Before entering into commercial transactions with firms in Turkey, of which the British manufacturer has no knowledge, he should invariably make inquiries either from the banks or the Consulate as to the integrity of the firm in question. There have been numerous cases during the current year of bands of swindlers who by their effrontery have pulled off successfully various commercial swindles.

A number of British firms have appointed agents and representatives in Constantinople and Smyrna, and a large portion of these are of foreign and in some cases of formerly enemy nationality. A Greek agent is liable to be called up for military service, and exemption is impossible. Stress cannot be too strongly laid on the inadvisability of appointing any other than a British subject as a representative. Cases have been reported of agents of foreign extraction obtaining representation of a British firm at the same time as of a firm of their own nationality, purely for the purpose of interfering with the former's sales. Largely owing to Russian influence in Constantinople advertising has become widespread. In pre-war days this science was in its infancy in the country. There are now numerous daily papers and weekly reviews, in which printed advertisements can be displayed to advantage, and in addition the whole town is covered with posters of all types of advertisements. The letterpress should be in French, and, if possible, Turkish.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries.

Sparta.—No. 404,410, Class 8.—Electric batteries. Fuller's United Electric Works, Grove Road, Chadwell Heath, Essex. May 20th, 1921.

Armalux.—No. 414,755, Class 8.—Electric primary batteries, electric wet and dry cells, &c. Arma Manufacturing Co., Ltd., 2a, Yonge Park, Seven Sisters Road, London, N. 4. April 29th, 1921.

J. Skinderviken.—No. 416,151, Class 8.—Electrical sound transmission instruments. Johan Skinderviken, 3, Colosseum Terrace, London, N.W. 1. June 15th, 1921.

The Drurion (lettering and design).—No. 415,552, Class 13.—Electric lamps, switches, sparking plugs, connections, and other like electrical accessories. J. M. Ukion and C. W. Drury, trading in co-partnership, Holborn House, 22, Gray's Inn Road, London, W.C. May 27th, 1921.

Engineering Employment in India.—As we so frequently receive postal inquiries regarding the chances of obtaining employment in overseas countries, it may be of interest to some of our readers if we quote from a letter recently written to *Indian Industries and Power* by Mr. Hugh W. Brady, as secretary of the Institution of Engineers (India), on the subject of engineering employment out there. He says: "Accounts of the hardships of the ex-service men now out of employment in large numbers in India are appearing in the Press. Many of the men are said to be trained engineers. Any such writing to me may have their names entered, free of all obligation, in the employment register maintained by the Institution of Engineers (India). Applicants for registration should (*a*) state nationality and date of birth, (*b*) give particulars of education and of engineering training, (*c*) give a synopsis of career, including experience in H.M. Forces and since demobilisation, (*d*) send copies only of testimonials, (*e*) state class of engineering work desired, and (*f*) not call at this office (Post Box 669, Calcutta) unless requested to do so. It is not considered likely that engineering employment can be found for any large number, but efforts will be made to put really well-trained engineers or engineering subordinates in touch with suitable vacancies."

The editor adds a foot-note to the letter stating that Mr. Brady has now been appointed Inspector of Factories of Behar and Orissa, but letters to him or to the Institution of Engineers will receive prompt attention.

An Electrical Demonstration at Bournemouth.—The British Electrical Development Association informs us that Mr. E. Brontman, of Parkstone, has arranged to give a lecture and demonstration on October 5th at St. Peter's Hall, Bournemouth. A number of prominent firms of electrical manufacturers and contractors are participating. An additional attraction, a "wireless" concert, is being arranged with the aid of the Marconi Scientific Instrument Co., Ltd.

Reval Port Improvements.—The Port of Reval is being enlarged to the utmost extent, and all modern improvements are being introduced in order to facilitate trade with Russia.—*Reuter.*

Inquiries.—The names and addresses of makers of machines for winding the cores of magneto armatures are required. The type needed has a hand-driven spindle, and is capable of holding different sizes of magneto cores. It is also fitted with some sort of reversible, geared, spiral drum, or a moving arm, to guide the wire on to the drum. A counting attachment is an extra refinement which can always be fitted afterwards.

The name of the makers of an electric curling iron bearing the letters "S.H.D.G." in the four quadrants of a circle, is required.

Rectifiers for the Chemins de fer du Midi.—We learn that in connection with the electrification of the above railway the Société Anonyme Brown, Boveri et Cie (the Swiss House of Power Rectifiers, Ltd.) has recently secured an important contract for the complete equipment of the five sub-stations of Pau, Lourdes, Tarbes, Montrejeau, and Lannemezan with mercury arc rectifiers. The contract comprises in all sixteen 1,200-kW rectifier sets to operate at a d.c. pressure of 1,500 volts. Each set consists of a single main transformer supplying two high-pressure rectifiers in parallel. The primary supply will be three-phase at 60,000 volts and a periodicity of 50 cycles. Everything from the high pressure to the d.c. side is included in the contract. The overload capacity for which the rectifiers are being designed is 50 per cent. for two hours and 200 per cent. for five minutes. The progress made during recent years with this class of plant is very marked, something like 160 individual equipments being either installed or in hand. They comprise roughly 340 separate rectifiers giving a total capacity of about 100,000 kW.

Engineering in China.—The North China Tung Chi Engineering Administration has been registered by the Ministries of the Interior and of Agriculture and Commerce.

Catalogues Wanted.—Mr. L. Henshaw, the electrical engineer, Public Works Department, Madras, India, wishes to receive price lists from suppliers of electrical machinery, fittings, and accessories; power plant up to 500 kW; and house lighting sets.

Messrs. H. Wogan & Co., 71, Stockport Road, Ardwick, Manchester, want catalogues of electric novelties, flash lamp cases, torches, and refills.

The Director of New Zealand Hospitals is anxious that equipment and supplies for those hospitals shall be obtained from the United Kingdom, and he has applied to H.M. Trade Commissioner at Wellington for assistance in obtaining catalogues from our manufacturers. American firms are noticeably enterprising in this respect, and we hope that British firms making a speciality of electro-medical, X-ray, and other such equipment will forward their catalogues, &c., in duplicate, direct to H.M. Trade Commissioner, P.O. Box 369, Wellington, N.Z., for transmission to the New Zealand Health Department.

New Indian Company.—The Godhra Electricity Co. is the name of a new undertaking which has lately been formed in Shahpur, Ahmedabad, with a capital of 1,000,000 rupees.

Calcutta Motor Show.—The Calcutta Motor Show will be held from December 19th to 24th. It will not be open to exhibits from enemy countries.

Birmingham Trade.—Our Birmingham correspondent writes: "The condition of the Birmingham electrical industry shows a little more animation than recently, and while there is a good deal of short-time working, better hours are being maintained than was the case a month ago. There is rather more doing, too, in the accessory branches of the trade, and small castings in aluminium for a variety of electrical work are figuring much more prominently."

LIGHTING AND POWER NOTES.

Alyesbury.—Loan.—A public inquiry is to be held on September 1st into the application of the Town Council for a loan of £27,632 for the purposes of the electricity undertaking.

Bath.—Price Increase.—Owing to the increased cost of production the charge for electricity for lighting is to be increased by 1d. per unit.

Belfast.—Finance.—The *Irish Independent* states that the Electricity Committee some time ago received a report from the consultants on the financial position of the undertaking as it was likely to be when the first section of the Harbour power station was completed. The city accountant stated that certain portions of this report could not be accepted, and others required explanation. The consultants thereupon desired to withdraw their report and to submit another, but it has been circulated to all the members of the Corporation and a summary has been published. From the report it is evident that the Corporation will have to increase its charges for electricity, although it is in the favoured position of owning the electric tramway system and of having the huge shipbuilding firms as customers for power supply. There is one very remarkable passage in the report. It is estimated that the contract prices for the electricity supplied to the shipyards would mean a deficit of over £50,000 a year.

Chester.—The Queensferry Plant.—The Queensferry T.N.T. factory, which has just been taken over by the Chester Corporation, contains three 1,500-kW turbo-generators; one 1,000-kW turbo-generator; one 90-kW, 410-volt d.c. generator, and one 37.5-kW, 100-volt generator. The turbines are of the three-stage horizontal Curtis type with a working pressure of 160 lb. per sq. in., and the alternators are three-phase, 440-volt, 50-cycle machines running at 3,000 r.p.m. A fourth 1,500-kW set was retained for emergency purposes. At the full productive period of the factory there were motors with a total horse-power of 8,618, and the highest record of units generated in one month was 2,588,991 units in November of 1917.

China.—The Sui An Electric Light Co. at Han Ti, Sui An, Chekiang has been registered by the Ministry of Agriculture and Commerce, as has also the Electric Light Co. of Hai Chia Chen, Taichow, Chekiang.

Continental.—France.—The price of electricity in Paris has been reduced by 10 per cent. for lighting and by from 25 to 50 per cent. for power.—*Reuter's Trade Service* (Paris).

Sweden.—A general outline of the present progress and future intentions of the Swedish Waterfall Board with regard to the State provision of electricity from water power is conveyed in a report to the Department of Overseas Trade by the Commercial Secretary to H.M. Legation at Stockholm (Mr. H. Kershaw), who recently visited the well-known installation at Trollhattan and the one in process of construction at Motala.

Trollhattan power station is situated about two or three miles from Lake Wennern, from which it draws its water supply. The superficial area of this lake is about 5,570 sq. km. At Trollhattan the Gota river is divided into three sections, one forming the traffic canal, the second being the canal which conveys the water for the power station, and the third being the original river proper which conveys the surplus water not required for the traffic canal or the power station. Lake Wennern can, however, be dammed at will, and it may be that in course of time, if the large extensions in contemplation are carried out, the whole of this large force of water from the lake will eventually be diverted for the production of electric energy. The present power station consists of eight turbines of 12,500-h.p. each, and five of 13,200-h.p. each, making an aggregate of 166,000 h.p.

The total energy delivered from Trollhattan in 1920 amounted to 431,500,000 kWh. The height of the fall at the works is 30 m., and the volume of the fall of water varies from 300 to 900 cu. m. per second; the average fall for the past two years has been 500 cu. m. per second. Trollhattan has 12 sub-stations equipped to transform down from 50,000 V to 20,000 and 10,000 V, for country purposes mostly, and down to 6,000 or 3,000 V for use in cities. Gothenburg, for example, is supplied at 6,000 V. The farthest transforming station is situated at Skofdo, a distance of about 100 km.

Motala lies about midway between Lake Boron and Lake Wettern. Work on the construction of the electric generating station and damming operations were begun in October, 1918, and it is expected that they will be completed (with two turbines) in April, 1922. The estimated cost of the undertaking with two turbines working and foundations ready for the installation of three other turbines is 12,000,000 kr. Arrangements are being made to operate eventually five turbines, each of 6,000 h.p., which will be directly coupled to generators. The current will be alternating 3-phase, 50-cycle, 6,000-V, which will be transformed up to 70,000 V.

Edinburgh.—Extensions.—Tenders are being invited for work at the new Corporation power station at Portobello. The erection of the pump house is now to be proceeded with as soon as possible. Sub-stations are also to be constructed at Gorgie and Morningside.

Hitchin.—Bulk Supply.—At a meeting of the Council a letter from the Electric Supply Corporation, Ltd., was read. It stated that although the taking of a bulk supply from Letchworth would be more expensive than a supply from Hitchin, the difference would not be great. If the Council did not agree to this it would necessitate new plant at Hitchin which would further increase the price.

Inverness.—Cost of Hydro-electric Scheme.—At a special meeting of the Town Council to consider the hydro-electric scheme drawn up by Messrs. Buchan & Partners (Electrical Review, June 24th, p. 818), it was stated that the cost would be approximately £230,000. The Council decided to obtain expert advice on the procedure necessary to secure legislation giving it powers to carry out the scheme.

Keighley.—Electricity Order.—The town clerk has received notice that the Keighley Corporation Electric Lighting Order, held up since 1915, will come into operation on September 1st, the official termination of the war. The order gives authority to supply light and power to out-districts such as Oxenhope, Oakworth, Steeton, Eastburn, Sutton, and Morton Banks. In recent times there has been a considerable demand for electricity in most of these districts. At Eastburn an overhead high-pressure cable, to supply large quarries there, is on the point of completion. This supply will augment the supply along the railless car route to Sutton and serve the districts through which the cable passes.

Newport (Mon.).—A Large Saving.—A saving of £15,000 will be effected through an agreement come to after considerable negotiation between the Corporation and the local Harbour Trust whereby the cables conducting electric power to certain big industrial consumers on the west side of the river Usk will be laid six feet below the river bed, instead of carrying them round by the bridge, a considerable distance away.

Rochdale.—Loan Sanctioned.—The Gas and Electricity Committee has obtained sanction to a loan for the purpose of extensions, new mains, and other work in connection with the electricity undertaking. A sub-committee has reported that it is having estimates prepared for lighting, both by gas and electricity, the Spotland and Turf Hill housing sites, and also for the better lighting of Drake Street and Oldham Road.

Selby.—Terms of Supply.—At a meeting of the Urban District Council, last week, a letter was received from the Electricity Commissioners stating that the maximum charge under the Order applied for by the Electrical Distribution of Yorkshire, Ltd., with respect to the supply of electricity to the area, would be 10d. per unit. The order also provided that the company should have two years in which to carry out its scheme. The terms were accepted by the Council.

Skegness.—Street Lighting.—Owing to the poor quality and low pressure of the gas supply, there have been complaints of inadequate street lighting, and a member of the Town Council has intimated that he will shortly introduce a scheme for providing public electric lighting.

Southend.—Repairing Damage by Fire.—The Electricity Committee has arranged to repair the damage caused by a fire at the electricity works last month, at a cost of £285.

Stirling.—Bulk Supply Inquiries.—The Town Council has decided to apply for terms for a bulk supply of electricity to the Scottish Central Power Co., and to the Alloa Town Council. Application has been made for a loan of £6,700 for a generating set.

Swansea.—Supply Failure.—Owing to a failure of the power at the electricity station, caused by the poor quality of some of the coal used, the tramway system was at a complete standstill for an hour on August 22nd.

United States.—Production of Electricity.—The United States Geological Survey has completed a tabulation of the operation reports for 1920, supplied by approximately 3,000 public utility power plants having a capacity of 100 kW and over. According to these figures the average daily output of electricity for each month of the year ranged from 115,600 kWh in May to 124,000,000 in January, the average for the whole year being 120,000,000. The proportion of this output resulting from water power varied from 33 per cent. in January to 42 per cent. in May. The total production for the year was 43,900 million kWh, an increase of 12.9 per cent. over 1919. Water-power supplied 37½ per cent. of this total, or practically the same proportion as in 1919. The amounts of coal, fuel oil, and gas employed to generate electricity in 1920 increased by 6, 18.4, and 13.6 per cent. respectively over the preceding year. If the fuel oil, gas, and wood consumed in generating electricity were converted into the equivalent amount of coal, the coal consumption would have been 38,500,000 tons in 1919 and 41,200,000 tons in 1920, an increase of 7 per cent. This increase in the amount of fuel consumed was, however, accompanied by an increase of 12.9 per cent. in the output, indicating a much more efficient consumption of fuel in 1920. On the basis of the equivalent coal consumed in each of the two years, the public utility plants burned 3.17 lb. of coal in 1919 to produce 1 kWh of electricity, and 3.01 lb. in 1920.—*The Times Engineering Supplement.*

Wales.—Electricity Orders Approved.—The Panteg, Bedwas and Machen, Mynyddislwyn and Risca Electricity Orders have been approved by the House of Lords.

Wrexham.—Suggested Curtailment of Staff.—Owing to the loss of £2,353 which has been incurred during the past three months, Mr. Coe, the engineer, is being strongly urged by the Council to reduce the staff at the works, but he replies that, though he is very anxious about the whole concern, he cannot further decrease the staff, having already cut it down to an absolute minimum. It is felt that increased prices will kill the demand, and the Council is to hold a special meeting at which its policy will be decided. Meanwhile, Mr. Coe has been asked to go carefully into the matter again and give to the Council a return of the staff which the undertaking "can afford to pay."

TRAMWAY AND RAILWAY NOTES.

China.—The Ministry of Communications has registered the Shanghai-Paoshan Tramway Co., for constructing tramways along the new roads between Shanghai and Paoshan Hsien.

Halifax.—Track Renewals.—The Tramways Committee is attending to the relaying of track, which is very badly needed. The committee has provisionally accepted tenders for 250 tons of rails and two other contracts for smaller quantities of tramway track metal.

Hendon.—Track Reconstruction.—After long delays and negotiations between the Hendon District Council and the Middlesex County Council, the work of reconstructing the tramway track along the Edgware Road from Cricklewood to Edgware has been begun. The whole work is estimated to cost £184,000, of which Hendon is to provide £86,000. This sum works out at £84,000 per mile. Prior to the war the undertaking would have been done for about £20,000. For a considerable distance a single track is now being used.—*Evening Standard.*

Lancaster.—Acquisition of Tramroad.—Lancaster and Morecambe Town Councils have appointed sub-committees to negotiate jointly for the purchase of the road rights held by the Lancaster and District Tramways Co. on the main highway between the two towns. The object, it is understood, is to get rid of the ancient horse tramcars still run by the company and, doubtless, to substitute electric or some other modern type of cars. Former attempts to secure the rights have failed.

Leeds.—Fare Increase Approved.—Ministry of Transport sanction has been received to the increase of maximum tramway fares from 1d. to 1½d. per mile. There has been a good deal of opposition, both locally and by out-districts served by the Leeds tramways, to the application, and it is not yet established that the increase will be applied to the full. The reduction of the amount of loss during July, as against previous months, gives the Tramway Committee grounu for hope that increases beyond the present advanced fares may be avoided, particularly if general industrial conditions—and thereby tramway traffic—improve.

London.—"Straphanging" Order.—At a meeting of the London M.P.'s held recently at the House of Commons, Mr. Gilbert presiding, strong objection was raised to the order of the Home Secretary, which comes into force on October 1st, prohibiting straphanging in the tramcars and omnibuses. The view was taken that great public inconvenience would result, and that numbers of people would be unable to get to and from their work. A deputation consisting of Mr. J. D. Gilbert, Sir Reginald Blain, Mr. Purchase, Sir W. Lane-Mitchell, Sir Alfred Yeo, and Lord Curzon was appointed to interview the Home Secretary on the matter.

Manchester.—Employes' Wages.—Mr. J. M. McElroy, the general manager of the Corporation tramways, states that when the adjustment of the wages of tramway employés, according to the fluctuations of the cost of living, was decided upon, on a national basis, the Manchester employés asked that their case should be considered separately. They contended that their wages were not equal to those paid by other undertakings of comparable size and conditions. This question was considered by the District Council on August 16th, when the employers maintained that the national character of the adjustments should be adhered to, and that the District Council was not competent to deal with departures from a national award. The matter is, therefore, to be decided by the National Joint Industrial Council of the industry.

"Straphanging."—The proposed revival of the regulations forbidding vehicles in the Metropolitan area to carry more passengers than they are licensed to carry, is not viewed with favour in Manchester. The Tramway Committee states that at present it cannot afford to buy new stock, and "straphanging" seems to be a simple solution of the traffic problem.

Nottingham.—Fallen Trolley Wire.—On August 19th a car had turned off Derby Road when the trolley pole swung loose and snapped the wire used for the purpose of keeping the live wire taut. The live wire also broke, but the repair staff were soon in attendance, and in three-quarters of an hour cars were again running, temporary repairs having been effected.—*Nottingham Guardian.*

Sheffield.—Year's Working.—The accounts of the Corporation Tramways Department for the year ended March 31st last record a total income of £998,427, as compared with £825,642 in the previous year. Working expenses amounted to £817,314, as against £679,173, leaving a gross profit of £181,113 (£146,469). After the payment of capital charges a net profit of £66,616 remained. Of this amount the greater part—£60,684—was transferred to the renewals fund.

South Africa.—Railway Electrification.—The South African Government, acting upon advice given by British electrical engineers, had determined to adopt the direct current system, but some prominence has recently been given in the Press of the Union to the statements of Dr. William Macdonald, who has just returned to South Africa after a visit to Italy, that the improved three-phase system which has been installed on railway lines in northern Italy is the most efficient system of electric traction in the world. An invitation has been extended to the Union Government to send electrical engineers to Italy to investigate this system from the technical standpoint, and it is suggested that pending such an inquiry no further steps should be taken by the Union Government to convert existing steam railways to direct-current working. It is quite unlikely that this controversy will exercise any influence on the policy of home railways, among the officials of which there is a strong consensus of opinion in favour of direct current installations.—*The Times Trade Supplement.*

TELEGRAPH AND TELEPHONE NOTES.

Belgium.—Automatic Telephones.—The Central Telephone Bureau, Brussels, is installing an automatic exchange, and the system is later to be extended to other offices in the district. The first one will be put into service in April next.

France.—Storm Damage.—The Doua wireless station, near Lyons, has been considerably damaged by a violent storm, two of the masts, more than 600 ft. high, having fallen. Communication with America and the Far East is consequently suspended for the present.

India.—Wireless Telephony.—The first practical use of wireless telephony in connection with the Press in the East was made recently when *The Times of India* received racing results by that method direct from Poona racecourse. The experiment by the postal authorities is attracting the widest interest, says *The Times*.

Jersey.—Telephone System.—The report of the expert recently appointed to study the local telephone system declared it to be most satisfactory, and it was decided to send a delegation to interview the Postmaster-General on the questions of staff and salaries.

Poland.—New Wireless Station.—It is stated that the Polish Government has made a contract with the Radio Corporation of America for the construction of a $3,000,000 high-power radio station at Warsaw, having direct connection with Rocky Point, Long Island. It is understood that the Polish Government will own the station, which will be operated in conjunction with the Radio Corporation for a period of 30 years.—*Financial Times*.

Russia.—Cable Party Captured.—The *Social Demokraten* learns from the Great Northern Telegraph Co. that the members of a caravan expedition sent from Pekin to Kiachta (Mongolia) in connection with the effort to re-establish communication with the Far East, via Russia, have been taken prisoners by freebooters in Russian Mongolia. So far the company has not received any confirmation of the concession from Russia.—*Evening News*.

Wireless Telegraphy.—Companies' Fusion.—The Stockholm *Svenska Dagbladet* states that the negotiations for the amalgamation of the English Marconi Co. and the Swedish Radio Co. have led to positive results, but the majority of the shares will remain in Sweden.—*Financier*.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Melbourne.—October 19th. Victorian Government Railways. Three-phase motors, starters, circuit breakers, and switches. Contract No. 34,181.*

P.M.G.'s Department, Queensland. October 12th. Galvanised iron and steel wire. Schedule 537, October 19th. Insulated wire. Schedule 538. (August 19th.)

Belgium.—Ministry of National Defence. September 14th. Establishment and equipment of a number of wireless telegraphy and telephony receiving and dispatching stations. 3° Direction Générale du Ministere de la Defence Nationale, 10, Rue du Meridien, Brussels.

Bristol.—September 16th. Electricity Department. One 500-kW rotary converter. (See this issue.)

Dorchester.—September 10th. Electricity Committee. Replating battery, &c. (See this issue.)

France.—September 1st. The Etablissement Centrale du Materiel de la Radiotélégraphie Militaire, 51, dis Boulevard de la Tour Maubourg, Paris.—2,000 40-volt, 3-amp.-hour accumulators.

Halifax.—September 10th. Electricity Committee. Steelwork in connection with foundations for new turbine set at the electricity generating station.—Mr. A. C. Tipple, acting borough engineer, Crossley Street.

Holsworthy.—September 1st. Urban District Council. Poles, fittings, &c., for electric lighting installation.—Mr. F. Vanstone, Surveyor, Council Offices.

Horsham.—September 3rd. Electricity Department. One 3-crank, triple-expansion engine, coupled to a 300-kW d.c., 460/500-V generator, or alternatively, one 2-crank compound engine, coupled to generator as above. (August 19th.)

Ilford.—September 9th. Electricity Department. Air compressor, motor and starter. (August 19th.)

India.—High Commissioner for India.—August 30th. Telegraph cable. (August 12th.)

London.—Fulham.—September 10th. Electricity Department. A.c. motor-driven centrifugal circulating pump with pipework and valves. (August 19th.)

Metropolitan Asylums Board.—August 31st. Electric lighting installation at the Grove Hospital, Tooting Grove, S.W. (August 19th.)

H.M. Office of Works. September 16th. Supply of electrical and mechanical labour-in-daywork in the Cardiff district. (See this issue.)

Lourenco Marques.—September 30th. Department of Posts and Telegraphs. 4,200 iron telegraph poles, 15,000 G.I. insulator stalks, 11,000 G.I. insulator brackets, 15,000 porcelain insulators, 320 tons G.I. wire, 90 tons H.D. copper wire.*

Malta.—September 15th. Government of Malta. Single-phase a.c. meters. (August 19th.)

New Zealand.—Wellington.—September 27th. Public Works Tender Board. Six sets 3-phase, 50,000-V air-break switches for the Waikato electric power scheme.*

November 29th. Public Works Department, Mangahao electric power scheme: 3 water wheels, three 6,000-kVA and two 3,000-kVA a.c. generators, two 3-unit exciter sets, seven 4,000-kVA single-phase transformers, insulators, lightning arresters, switchboard, &c.*

Portsmouth.—August 30th. Tramways Committee. Stores, 12 months (including insulating materials, lamps, line materials, &c.). (August 19th.)

South Africa.—Pretoria.—October 4th. Electric Light and Power Department. Coal-handling plant, 6,600-V cables, induced-draught and ash-handling plant, pumps, piping, &c.—Mr. T. C. Wolley Dod, General Manager, Municipal Electricity Supply, P.O. Box 423, Pretoria.

Durban.—August 31st. Corporation. One 3,000-kW, three-phase, 50-period, 6,600-V turbo-alternator with condensing plant, circulating water pump and piping. (August 19th.)

September 28th. Corporation. Two 500-kW rotary converters, switchgear, and automatic controlling devices, also h.p. supply feeders.*

Johannesburg.—November 7th.—South African Railways and Harbours. 85,560, incandescent train lighting lamps (tungsten filament) for 24 volts, 8 to 10 candle power. 8,125, engine headlight lamps, 150-watt, 32-volt (gasfilled type with concentrated filament). 50,472, incandescent lamps (tungsten filament), and 5,545, incandescent lamps (carbon filament).*

Salford.—August 29th. Coal supplies for Electricity Department for six months.—Borough Electrical Engineer, Frederick Road, Salford.

Southampton.—August 30th. Electricity Department. E.h.p., 3-phase cable. (August 12th.)

Stockton-on-Tees.—August 31st. District Fund, Gas and Electricity Committees. Articles and stores for six months. (August 5th.)

Uruguay.—September 19th. Board of State Electrical Stations. Generating plant for four electrical groups, consisting of a.c. and d.c. generators, Diesel engines, &c.*

West Ham.—September 8th. Board of Guardians. Three months' supply of electrical fittings. Mr. T. Smith, clerk to the Guardians, Union Road, Leytonstone.

* A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

CLOSED.

Blackpool.—Accepted:—
Wiring the new secondary school off Poulton Road.—R. Barron, Blackpool.

Battle.—Board of Guardians. Accepted:—
Renewal of plates in storage battery, £145.—Tudor Accumulator Co.

Pewsey.—Board of Guardians. Accepted:—
Electric light installation, £148.—Lotts & Co

Government Contracts.—The following Government contracts were placed during July, 1921:—

Admiralty (Contract and Purchase Department).
Electrical installation.—Johnson & Phillips, Ltd.
Switches.—A. Gabriel & Co.; A. Graham & Co.; General Electric Co., Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell, Ltd.; Wandsworth Electrical Manufacturing Co., Ltd.
Overhead electric traveller.—Sir W. Arrol & Co.

Admiralty (Civil Engineer-in-Chief's Department).
Battery repairs.—R.N.V.R., St. Leonards-on-Sea: G. Lynn & Son.

War Office.

Crucibles.—Morgan Crucible Co., Ltd.
Electric cells.—Fuller's United Electric Co., Ltd.
Telephone parts.—British L.M. Ericsson Manufacturing Co., Ltd.
Rotary transformers.—W. Mackie & Co.; Newton Bros., Ltd.; Small Electric Motors, Ltd.

Air Ministry.

Control boxes.—H. W. Sullivan.

Post Office.

Telephone apparatus.—British I. & H. Cables, Ltd.; General Electric Co., Ltd.; Peel-Conner Telephone Works, Ltd
Testing, protective apparatus,, &c.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—British I. & H. Cables, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Gasfilled lamps.—British Thomson-Houston Co., Ltd.; Edison Swan Electric Co., Ltd.; English Electric & Siemens Supplies, Ltd.; General Electric Co., Ltd.
Glow lamps.—British Thomson-Houston Co., Ltd.
Thermionic valves.—General Electric Co., Ltd
Enamelled and cotton lapped wire.—Macintosh Cable Co., Ltd.
Laying conduits.—Hawarden-Rhyl (Section 1): Hodge Bros. (Contractors), Ltd. Marple: Whittaker Ellis, Ltd. Bishopsgate: Grieg & Matthews. Hawarden-Rhyl (Section II): G. P. Trentham, Ltd.; (Section III): W. Pollitt & Co., Ltd. Hastings: H. Farrow.
Manufacture, supply, drawing-in, and jointing cable.—Colchester-Ipswich: Johnson & Phillips, Ltd. Ware-Hertford: Johnson & Phillips, Ltd. Marlborough-Bristol: Western Electric Co., Ltd. Airedale junctions: British I. & H. Cables, Ltd.
Telephone exchange equipment.—Blackpool: Peel-Conner Telephone Works, Ltd. Great Yarmouth: Western Electric Co., Ltd.

Crown Agents for the Colonies.

Battery materials.—Siemens Bros. & Co., Ltd.
Distribution boxes, &c. (pole).—Siemens Bros. & Co., Ltd.
Telephone exchange.—British L.M. Ericsson Manufacturing Co., Ltd.
Telephone materials.—British L.M. Ericsson Manufacturing Co., Ltd.
Train lighting spares.—J. Stone & Co., Ltd.
X-ray apparatus.—F. R. Butt & Co.
Forced draught cooling tower.—Davenport Engineering Co., Ltd.

High Commissioner for India.

X-ray apparatus.—Watson & Sons (Electro-Medical), Ltd.
Cable.—Western Electric Co., Ltd.
Cells.—Tudor Accumulator Co., Ltd.; Chloride Electrical Co., Ltd.
Cords.—Peel-Conner Telephone Works, Ltd.
Insulation cups.—General Electric Co., Ltd.
Rotary converters.—Metropolitan-Vickers Electrical Co., Ltd.

Public Works, Dublin.

Electric bell installation.—New Public Offices, Dublin: V. G. Middleton & Co., Ltd.

NOTES.

The I.E.E. Royal Charter.—At a meeting of the Privy Council held at Buckingham Palace on Wednesday, August 10th, 1921, the petition of the Institution for a Royal Charter of Incorporation was approved, and a Royal Charter has now been granted. His Majesty the King has also been graciously pleased to intimate his willingness to become Patron of the Institution.

New Electric Signalling Device.—A Committee of the Ministry of Transport is shortly to visit Liverpool to inspect a new system of railway signalling which has been adopted by the Liverpool Overhead Railway Co. along the five miles of double track between the Alexandra and the Herculaneum Docks. Automatic electric lamp signals have been substituted for the semaphore arm signals, and an advantage is that even in broad daylight the signal is more easily seen than the ordinary signal arm. The Liverpool Overhead Railway Co. now employs 26 of these new signals, which are worked by the trains themselves switching on the respective lights behind the coloured lenses. If the train runs past a signal set at danger, a circuit brake comes into operation, and by cutting off the power and applying the train's brakes, pulls it up within 300 feet.

Engineering Training in China.—The Chiaotung (Communications) University was formally opened on July 1st. This new institution will unify and improve the technical education that has been afforded in the past by the Railway Administration College, the Postal and Telegraph College, and the Shanghai and Tangshan Colleges. It is hoped to model the training of China's future engineers on the best standards prevailing in modern universities.

Ship-propelling Machinery.—An excellent condensed account of the various types and arrangements of ship-propelling plant is given in the *Pacific Marine Review*, which states that the more common systems that have been applied to merchant vessels are: (1) Direct connected reciprocating engine; (2) direct connected turbine; (3) geared turbine; (4) turbine-electric, with direct connected motor; (5) turbine-electric, with

Drive	Fuel Consumption.	Machinery Weight.
Geared Turbine ...	1 ...	1
Turbine Electric ...	1.06 ...	1.05 to 1.10
Direct-connected Diesel	.49 ...	1.10 to 1.25
Diesel-electric ...	.57 ...	.75

geared motor;; (6) internal combustion engine, direct connected; (7) ditto geared; (8) internal combustion engine, using direct-connected motors. The author examines each type in turn from the point of view of first cost, general running capabilities, and cost. The above figures are based on a 3,000 h.p. ship operating over a 4,000-mile course at a speed of 11 knots and making 14 single trips per year, the geared turbine ship being taken as unity.—*Technical Review.*

Tests on Coal-cutter Connections.—Messrs. Anderson, Boyes & Co., Ltd., Electrical Works, Motherwell, who specialise in coal-cutting plant, have had a series of tests carried out at their works, by Prof. Burns, of the Royal Technical College, Glasgow, to demonstrate that a rectangular type of trailing cable plug attached to a coal cutter is capable of being used in an explosive mixture of gas and air. The tests were most successful.

Radium in Belgian Congo.—During the war British geologists discovered exceptional quantities of radium in fragments of colcobite, sold in London by a Belgian coming from the Belgian Congo. Efforts to trace the former owner of the specimens failed, and the exact spot where the mineral had been found was not determined. The *Effort du Katanga*, an Elizabethville newspaper, states that radium has now been discovered in the Belgian Congo, and that a special mission is to be sent to investigate the importance of the discovery.—*Financial Times.*

Fatalities.—Six people were killed during a storm at Florence on Friday, when an electric power station was struck by lightning, and three persons were killed in the village of Romito, near Florence, where a cottage was struck and a fire started which spread and destroyed several houses.—*The Times.*

Underground Conduit-return Lighting System.—An article describing a series system of street lighting that involves the use of the conduit as the return conductor, which was installed at a cost equalling about 33⅓ per cent. of the usual system, is described in the *Journal of Electricity*, from which we learn that tests made with 6.6 amps. at 50 cycles before installation indicated that the voltage drop per 1,000 ft. of conduit was 14.2 with a complete copper circuit, and 10 volts when using the conduit as a common return, with a power loss of 32 and 45 watts respectively. The voltage drop is reduced because the reactance is diminished. Half-inch galvanised conduit was employed in 300-ft. runs, so that special methods employing compressed air had to be used to draw in the wires. The conduit was fixed and earthed to each lamp-post, and the maximum voltage between the conductor and the conduit exists only at the feed point. No difficulties are encountered, it is said, when it becomes necessary to install new posts between the existing ones, and trouble is very easily located because, in the case of an earth, all the lamps beyond the fault go out. The system has been in operation for over four years without having given any trouble.

New Ships.—S.s. "Scythia."—The actual performance of the new s.s. *Scynthia* on her maiden voyage to New York this week will be watched with interest. She is the largest Cunard liner built since the war, being of 21,000 tons gross displacement, and up to the present is also the largest passenger-carrying vessel on the Atlantic specially designed and built to burn oil fuel; she possesses propelling machinery of the double reduction geared turbine type. Her electro-hydraulic auxiliary machinery also represents a notable advance on previous practice.

S.s. "Baradine."—This twin-screw passenger steamer, built to the order of the Peninsular & Oriental Steam Navigation Co., by Messrs. Harland & Wolff, Ltd., for the branch line service between London and Australia, left port on the 18th inst., after undergoing successful trials in Belfast Lough. The principal dimensions are: Length, 537 ft.; breadth, 64 ft.; and depth 41 ft., with a gross tonnage of about 13,300. The new vessel, which is class 100 A1 at Lloyds, has a very complete electrical installation, consisting of four main generators, in addition to which there is a vertical oil engine driving a dynamo. The watertight doors are all operated and controlled electrically from the captain's bridge. There are two electrically-operated lifts for the pantry, and among the service machinery there is electrically-driven apparatus for mixing the dough, washing dishes, and peeling potatoes. The ship's whistle is automatically operated electrically from the captain's bridge. Among the other electrically-driven gear are included large forced-draught fans for the boilers, refrigerating fans and the ventilation fans throughout the vessel. Special attention has been given to the ventilation, so as to give the maximum comfort to passengers in hot weather. Loud-speaking telephones are available to assist in the navigation of the ship, and there are considerably over 1,000 lights installed, and over 70 motors.

S.s. "Majestic."—This White Star liner will make her first voyage on the Southampton-Cherbourg-New York service next spring. She is 956 ft. long and has a displacement of 64,000 tons when loaded; her 100,000 h.p. will enable her to steam 23 knots, and she will carry sufficient oil fuel for the round trip. Her electrical equipment is considerable, and includes electric baths. She will carry two motor lifeboats fitted with wireless telegraph apparatus, and the vessel herself will have three wireless stations, the largest being capable of maintaining communication with land stations throughout the voyage. The *Majestic* was formerly the *Bismarck*, and was in course of construction at Hamburg when the war broke out.

Railway Expert Wanted.—According to Reuter's reports from Adelaide, the South Australian Government is searching for an expert of the widest possible experience in either England, America, or Australia, to take supreme control of the State railways.

X-ray Treatment of Cancer.—The following statement has, according to *The Times*, been issued by the Council of the British Association for the Advancement of Radiology and Physiotherapy, in view of the publicity that has been given to radiotherapy in the treatment of cancer by the publication of laudatory articles in the medical and lay Press, and the extraordinary claims that have been put forward by the authorities of the West London Hospital. The treatment referred to has not yet been thoroughly tested. It possesses great potential dangers, and may not prove as efficacious as the claims now made would suggest; however, no certainty can be arrived at for some years. The unwarranted laudation of this change in technique will probably lead to a reaction, and bring discredit upon X-ray treatment in general.

The claim put forward by the Erlangen school is that it is possible to administer a dose of X-rays which will cure cancer in one application. This claim is commented on as follows by the *Lancet* of July 2nd, 1921 :—

"The suggestion that cases of malignant disease should go to the radiologist immediately the diagnosis is made, and before operation, is based on the observation of competent observers. There is little doubt that the time has come for us to reconsider our position in dealing with the situation."

This is regarded as a most ill-advised pronouncement, and the Association emphatically disagrees with the conclusions expressed. The time has not yet come when radiotherapy may be regarded as the first choice in the treatment of the majority of cases of cancer.

The Association believes that, of any single method, surgery still offers the best prospect of cure in nearly all cases of cancer, and that until much more convincing proof of the efficacy of X-rays or other form of radiation is forthcoming it would be extremely dangerous to encourage patients to trust to X-rays treatment alone.

It is, however, of the opinion that a closer co-operation between the surgeon and the radiologist would lead to a clearer appreciation of the value of radiation in treatment. Combined treatment offers the greatest hope of success.

Radiologists in this country have, during the past few years, so far perfected their technique that the risk of any injury to the patient is now small, provided that his treatment is under the direction of a medical man of wide experience in this class of work, and the public may rest assured that if the prospects held out by the more drastic procedure prove to be better than those offered by existing methods full advantage will be taken of it in this country.

The Association holds that the real contribution to progress on the part of the Erlangen school is that it has employed in suitable quantities X-rays of a higher penetration than those hitherto used, and has also carefully systematised already known methods of measuring dosage. Several firms in this country are now making the requisite equipment, so that difficulty of obtaining plant will not be a bar to research.

X-rays have already relieved suffering and prolonged active life in thousands of cancer victims. They have even effected a few apparent cures; and their value in helping to prevent return after operation is now generally recognised. It would, therefore, be neither more nor less than a calamity if public disappointment resulting from unfulfilled promises were to bring discredit on radiation therapy, which is in reality a powerful agent in the warfare against disease.

Power Station Employés' £5,000 Claim.—A few months ago two employés at the Johannesburg power station were dismissed by the municipality and expelled from the Engineering Union. The expulsion was declared illegal by the Court, and one of the two men (Mr. Young) has commenced an action against the Union claiming £5,000 damages. The action will shortly be heard in the Supreme Court.

Appointments Vacant.—Power station maintenance engineer (£392) and resident station engineer (£534), for the Yorkshire Electric Power Co.; assistant sub-station engineer, for the Shanghai Municipal Electricity Department (350 taels per month, tael=3s.); shift engineer, for the Doncaster Corporation Electricity Works; teacher of electrical engineering and mathematics, for the Doncaster Technical College. (See our advertisement columns to-day.)

Petrol-electric 'Buses for London.—Messrs. Tillings, Ltd., announce that they are shortly introducing an improved type of omnibus to replace those which they are now running in London. The drive will be effected by motors supplied with electricity generated by a petrol engine. The carrying capacity will be for 48 passengers, and about 150 of these vehicles are to be put into service.

Speech Projection.—The *Electrical World*, in a recent issue, reproduced a photograph of a speech-projection equipment constructed by the American Telegraph & Telephone Co. This consists of a tower about 30 ft. in height, on the top of which four loud-speaking projectors are mounted. Under the tower is a speaker's platform on which are fixed a number of electrostatic transmitters. About twelve feet above this platform a single speech projector is installed, and this created a record by rendering speech audible at a distance of 3.8 miles. The energy amplification is stated to have been 10^{11}.

Making Ice Cream Electrically.—Keeping a community cool in the summer is a task that demands as much electricity as that of keeping it warm in winter. An interesting description of ice cream making in the *Journal of Electricity* is typical of the extent to which manufacturing plant of all kinds is becoming dependent on electric power. The Benham Ice Cream Co., of Fresno, U.S.A., has an output of 650,000 gallons per year; during the summer the plant is run on a 24-hour basis, and 4,500 gallons of cream are used per day, representing the yield of 5,000 cows. About 500,000 lb. of sugar and 500 tons of salt are consumed a year, and all the ice needed is manufactured in the factory, the daily "refrigerating capacity" of the plant being 80 tons and the output of the two ice crushers 20 tons per hour. The four 100-gallon per hour freezers are each driven by a 7.5-h.p. motor, and the 12 40-gallon ones by 2-h.p. motors. The plant includes a 50-h.p. steam boiler for sterilising and heating purposes, and for condensing the surplus milk. Water is pumped from private wells for all uses in the factory; the principal compressor is driven by a 75-h.p. motor, and there are two smaller ones driven by 25-h.p. machines. There are 34 motors in all with a total capacity of 226 h.p., and the maximum 15-minute demand to date is 181 h.p. The company operates specially built trucks for distributing its product locally; it uses 20 vehicles, part of which are Walker and part General Vehicle "electrics," having a capacity of 300 gallons of ice cream and two tons of ice and salt. Some of the vehicles are nothing less than refrigerating rooms on wheels, being fitted with brine circulating pipes so that the compartments in which the ice cream is stored for delivery are kept cool. One of the most novel features is the latest electric truck, which has been equipped with a complete refrigerating plant; the truck has two product compartments and is fitted with an electrically-driven system instead of refrigerating by means of salt and ice. The company operates its own vehicle-charging outfit, using a motor-generator set for the purpose. The use of electricity in ice cream plant facilitates a process which is very exacting, is subject to very heavy demands during the rush season, and requires great flexibility. On account of the requirements for complete sanitation, individual electric drive is considered the only satisfactory method; operators, in fact, never have to think of their driving apparatus and are free to give all their attention to the manufacture and delivery of a product in which uniformity and reliability are particularly to be desired.

The plant represents an investment of over a quarter of a million dollars, and it is said that it is the most complete and largest of its kind west of Chicago, not even excepting the San Francisco and Los Angeles factories.

Closed Labour Exchanges.—In accordance with the policy announced in the House of Commons on August 4th, the Ministry of Labour is closing down country labour exchanges in North Devon. "I am taking steps to close 84 rural exchanges immediately, and 150 or more will be shut down by the end of the year," Dr. Macnamara is reported to have said.

Educational.—Bachelor of Commerce Degree.—At the beginning of the autumn session of the University of London in October next, four students will begin four years' training for the degree of Bachelor of Commerce. They are the successful candidates for the four £250 Scholarships offered by *The Daily Mail* in connection with the Efficiency Exhibition held in February last.

The qualifying examination was the Matriculation Examination of the University of London, held in June last. The winners of the scholarships are the students who, having completed *Daily Mail* entry forms, were placed highest on the list of candidates for that examination. Each of the winners is engaged and has undertaken to continue to be engaged in whole-time employment in business while pursuing a regular course of study for the degree of Commerce.

The administrative work in connection with the scholarships will be carried out by the authorities of the University of London.

Institution Note.—Association of Engineers-in-Charge.—The 21st Annual Dinner of the Association which was postponed owing to the coal miners' strike, will take place on Saturday evening, October 8th, at the Holborn Restaurant at 6 p.m. Mr. W. H. Patchell (president) will preside, and the principal guest of the evening will be Engineer Vice-Admiral Sir George G. Goodwin, K.B.C., LL.D., Engineer-in-chief of the Fleet, who will be supported by many eminent representatives of the engineering world.

A Ladies' Night, consisting of a dinner and dance, will be held by the Association at the Holborn Restaurant on Saturday Evening, November, 12th. The Chairman of the Association (Mr. J. E. Watkins) will preside.

Medals for Resuscitation.—The Accident Prevention Committee of the Canadian Electrical Association offers a medal to any person who saves the life of another, who has received an electric shock, by artificial respiration. The first lot of these medals will be struck, very appropriately, from copper taken from the first high-pressure transmission line in the British Empire, installed 30 years ago.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

We shall be glad if electrical and allied men who are proceeding overseas on business visits, will acquaint the Editors of the Electrical Review with their movements. Equally acceptable to us will be notification from our overseas friends when they are visiting this country; the date of arrival and their address here, if known, would be of interest to our readers, and of value to the trade, while the objects of the visitor might be more easily attained, and the visit made more successful. Many of our friends already keep us posted, but we should like more to do so.

Mr. E. A. Gatehouse, until recently assistant manager of the contract department of the British Thomson-Houston Co., Ltd., has relinquished that position in order to join the staff of the Electrical Review. On leaving Rugby Mr. Gatehouse (who is the son of the late Mr. T. E. Gatehouse, well known as the editorial and technical editor of the Electrical Review) was entertained at dinner by a large number of the staff, who presented him with some handsome Georgian silver plate as a token of their regard.

Mr. H. North, of the Engineer-in-Chief's Office, General Post Office, retires this month. He has been connected with the Post Office for upwards of 40 years. Some of our readers will remember his work in connection with the Ghent International Exhibition in 1913. He organised the Post Office exhibit in the British section, and superintended the erection of representative apparatus from the various sections of Postal telegraph, telephone, pneumatic, savings bank and money order departments, and was awarded a diploma for his services. On the outbreak of war, Mr. North took a prominent part in the volunteer movement, and early in 1915 opened a free school for instruction in signalling, at the Inns of Court Hotel, London. Lord French inspected the school on June 6th, 1916, and was very favourably impressed. Upwards of 1,200 students were passed into the various signal units from this school. In retirement Mr. North will be devoting his energies to electrical matters, for he now represents the Fahnestock Electric Co., of New York, Ferodo, Ltd., &c., whilst at his rooms at 264, High Holborn, W.C. 1, he will continue his experiments in wireless telegraphy.

Mr. H. W. Puttick, A.M.I.Mech.E., A.M.I.E.E., has resigned his position under the Calcutta Electric Supply Corporation, Ltd., and will be returning to England at the end of October.

Mr. J. Wallis Bailey, the hon. secretary of the South Midland Students' Section of the Institution of Electrical Engineers, has changed his address to c/o Messrs. General Electric Co., Ltd., Witton, Birmingham. He will be glad to hear from student members desirous of reading papers during the forthcoming session.

The Southport Corporation Electricity Committee has decided that the salary of the new borough electrical engineer, when appointed, shall be at the rate of £800 a year, rising by annual increments of £50 to £1,000. The salary of the present borough electrical engineer, Mr. A. S. Black, who has been appointed borough electrical engineer and tramways manager at Ipswich, is £400, plus £300 bonus. At Ipswich he will receive £900.

It is refreshing to note that there are no fewer than three engineers standing for Parliament in the bye-elections now proceeding. Mr. Arnold Lupton, the Liberal candidate for Westminster, is a mining and civil engineer in practice there. Sir Alan Hutchings, the Conservative candidate for Louth, is a member of the Surveyors' Institution, and Sir Philip Dawson, the well-known railway electrical engineer, is standing for Lewisham as a Conservative. Apart altogether from their politics, we should rejoice to see practical and constructive men of this type in Parliament.

Mr. Wilfred Evans, foreman for four years of the electrical department of the Briton Ferry Chemical Works, has been appointed, out of a large number of applicants, head of the electrical department of the State railways of the Malay Peninsula at a commencing salary of £750 per annum, and sails for Malaya on October 1st. Mr. Evans is a member of the Technical Advisory Committee of South Wales for Electricity and chairman of the Port Talbot Branch of the Electrical Trades Union.

The marriage took place on August 17th, at the Cathedral Church, Chelmsford, of Mr. Cyril Herbert Ford, A.M.I.E.E., of the staff of the Marconi Co., Chelmsford, and Miss Kathleen Millicent Manning.

Signor Marconi, who has been spending a few days at Aberdovey in connection with wireless experiments he is making on his steam yacht *Electra* off the Welsh coast, has been presented with an address by the Aberdovey Council.

Mr. C. H. Dolling, who has been appointed tramway permanent way engineer to the Halifax Corporation—a new office created by the taking over of the whole of the lines (formerly partly under Highways Department control) by the Tramway Committee—was on the staff of the Rochdale borough engineer.

Mr. W. G. Wickham, H.M. Senior Trade Commissioner in South Africa, who is at present in this country on an official visit, is prepared to interview at the Department of Overseas Trade in London, from September 1st to 16th, firms who desire to consult him regarding South African trade possibilities, &c.

The following appointments have been made in the Faculty of Engineering at University of London, University Conege: Mr. M. T. M. Ormsby (previously reader in surveying), to be Chadwick Professor in Municipal Engineering; Mr. Bernard H. Knight, to be Assistant in Municipal Engineering; Mr. H. T. Davidge, to be Senior Lecturer in Civil and Mechanical Engineering.

The Rt. Hon. Earl Buxton, G.C.M.G., has accepted an invitation to join the board of the British Thomson-Houston Co., Ltd.

Obituary.—Sir Samuel Davidson.—We regret to record the death of Sir Samuel Davidson, K.B.E., founder of the Sirocco Engineering Works, which occurred at Belfast on August 18th, at the age of 75 years. It will be remembered that on the occasion of the recent visit of the King to Belfast the honour of knighthood was conferred upon the deceased gentleman, who was too ill to be present in person. We published an account of Sir Samuel's career, together with a photograph, in the Electrical Review for July 1st, 1921 (p. 20).

Ald. H. Linsley.—The death took place last week, at the age of 73 years, of Ald. H. Linsley, chairman of the Salford Corporation Tramway Committee since its inception twenty years ago.

NEW COMPANIES REGISTERED.

Frank Rawcliffe & Co., Ltd. (176,278).—Private company. Registered August 15th. Capital, £12,000 in £1 shares. To take over the business of an electrical engineer and factor carried on by F. Rawcliffe at 8, Nun Street, 16, Westmoreland Road, and 49, Westgate Road, all in Newcastle-on-Tyne, and 94, Victoria Road, Darlington, as "Frank Rawcliffe and Co." The first directors are: F. Rawcliffe (managing and permanent director), 9, Queen's Gardens, Benton; J. McGhee, 9, Queen's Gardens, Benton. Qualification, 1 share. Remuneration as fixed by the company. Registered office: 8, Nun Street, Newcastle-on-Tyne.

Modern Electrical Supply Co., Ltd. (176,286).—Private company. Registered August 15th. Capital, £1,500 in £1 shares. To take over the business of electrical engineers formerly carried on by G. F. A. Stone and G. A. Davenport at 14, High Street, Pinner, and to carry on the same and the business of dealers in electrical goods, &c. The permanent directors are: A. T. Whittle (governing and managing director and chairman), Paines Lane, Pinner; G. F. A. Stone (sales manager), 14, High Street, Pinner; G. A. Davenport (works manager), 14, High Street, Pinner. Qualification of managing director 400 shares; of other directors 1 share. Remuneration as fixed by the company. Registered office: 7-9, Whitecross Place, Wilson Street, Finsbury Square, E.C. 2.

Ohms, Ltd. (176,318).—Private company. Registered August 16th. Capital, £400 in £1 shares. To carry on the business of electricians, electrical engineers, and contractors, &c. The subscribers (each with one share) are: W. J. Wood, 34, Shakespeare Road, Acton, W. 3, solicitor's clerk; W. J. Lovell, 110, Maryland Road, Wood Green, N. 22, solicitor's clerk. The first directors are to be appointed by the subscribers. Solicitor: A. L. Horner, 199, Piccadilly, W. Registered office: 41, Upper Berkeley Street, W. 1.

Wren Three Link Patent Safety Coupler, Ltd. (176,331).—Private company. Registered August 16th. Capital, £1,500 in £1 shares. To carry on the business of electrical, mechanical, motor, and general engineers, iron and brass founders, boiler makers, wire drawers, iron and steel cable makers, &c., and to adopt an agreement with A. Wren. The subscribers (each with one share) are: G. T. Little, 7, Dorncliffe Road, Fulham, S.W. 6, clerk; F. W. Eve, 38, Salmon Lane, Limehouse, E. 14, clerk. The subscribers are to appoint the first directors. Solicitor: A. Barrie, Balfour House, Finsbury Pavement, E.C.

Engineers' Club (London), Ltd. (176,343).—Registered August 17th as a company limited by guarantee. To promote the interests of engineers generally and provide a club house for a club in course of formation to be known as the Engineers' Club. The first directors are: E. Manville (M.P. for Coventry), 39, Coventry Street, W.; E. L. Hill, 39, St. James's Street, S.W. 1; P. C. Pope, Wainholm, Toddington, Beds. E. Manville, M.P., is the first president. Registered office: 39, Coventry Street, W. 1.

British Samples, Ltd. (176,336).—Private company. Registered August 17th. Capital, £3,000 in £1 shares. To organise and conduct exhibitions in the United Kingdom and other countries with the object of promoting British manufacture and trade, and fostering the relationships between manufacturers and consumers throughout the world, and between exporters abroad and consumers in the United Kingdom and other countries, and for that purpose to co-operate with newspapers in cataloguing and advertising of exhibits; to act as agents for exhibitions organised by other concerns, &c. The subscribers (each with one share) are: G. B. Crowder, 51, Lincoln's Inn Fields, W.C.2, solicitor; H. G. Russell Smith, 51, Lincoln's Inn Fields, W.C. 2, solicitor. The subscribers are to appoint the first directors. Registered office: 51, Lincoln's Inn Fields, W.C.2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Illuminated Sign Co., Ltd.—Particulars of £10,000 debentures, authorised July 11th, 1921; present issue £1,000; charged on the company's undertaking and property, present and future, including uncalled capital.

A. Hirst & Son, Ltd. (57,889).—Return dated July 5th, 1921. Capital, £20,000 in £10 shares (100 preference and 1,900 ordinary); 100 preference and 1,220 ordinary shares taken up; £2,200 paid; £11,000 considered as paid. Mortgages and charges: Nil.

Metropolitan-Vickers Electrical Co., Ltd. (62,919).—Return dated May 4th, 1921. Capital, £6,395,000 in 616,525 preference shares of £2 each, 5,136,950 ordinary shares of £1 each, and 500,000 deferred shares of 1s. each; 616,525 preference, 1,136,950 ordinary, and 500,000 deferred shares taken up; £2,245,000 paid; £150,000 considered as paid. Mortgages and charges: £1,395,153.

Rangoon Electric Tramway & Supply Co., Ltd. (86,932).—Return dated June 1st, 1921. Capital, £500,000 in 50,000 preference shares of £5 and 250,000 ordinary shares of £1 each; 50,000 preference and 177,001 ordinary shares taken up; £302,001 paid on the preference and 112,001 ordinary shares; £65,000 considered as paid on 65,000 ordinary shares. Mortgages and charges: £249,739.

CITY NOTES.

Vera Cruz Electric Light, Power and Traction, Ltd.

The annual meeting was held in London on August 17th. Mr. Vincent W. Yorke (chairman), who presided, said that the gross earnings of the company continued to increase satisfactorily although operating expenses had also increased. A serious strike of the tramway employés in September had reduced the income considerably. To meet an increase in wages awarded to the men, the company had been permitted to increase its fares. The lighting and power business had shown good results, the combined net earnings for the current year being about 25 per cent. in excess of those for the corresponding period of 1920. The opening up of a bathing resort, in which the company had an interest, near Vera Cruz, would add considerably to the earnings of the tramways. The stand-by Diesel plant, which was used in the event of a failure of the supply from the Puebla Tramway, Light & Power Co., was very old, and it would be necessary to install a steam turbine within the next few months. The political conditions in Mexico remained satisfactory, and if these continued so, and if labour troubles could be avoided, 1921 should prove a very satisfactory year.

Swiss Companies.

The *Watt A.G. fur Elektrische Unternehmungen*, of Glarus, which is associated with the Zurich Bank for Electrical Undertakings, reports a slight increase in the deficiency in 1920-21 to 2,891,000 fr., and the loan capital again receives no interest.

The report of the *Maschinen Fabriken Escher Wyss & Co.*, of Zurich, states that the volume of the turnover in the year ended on March 31st, 1921, was approximately the same as in the previous year, although sale prices considerably declined. After making provision for depreciation, the accounts record net profits of 809,000 fr., as against 804,000 fr. in 1919-20, and the dividend remains at 6 per cent. as in the preceding year.

The report of the directors of *Brown, Boveri & Cie.*, of Baden, dealing with the year ended on March 31st, 1921, states that the sudden falling off in the sales of electric motors which took place in September was followed by stagnation of business in large machines in the following month. This change would have had no direct consequences on the activity of the works at first, as orders were on hand for a long time forward. But the stagnation led to a rapid fall in the prices for all raw materials and for manufactures, which decline reached extraordinary dimensions in the first quarter of 1921. If this situation had not arisen, the working results for the year would have been entirely satisfactory despite other unfavourable factors. The accounts show net profits of 666,000 fr., as compared with 5,084,000 fr. in 1919-20, when a dividend at the rate of 8 per cent. was paid. As a consequence of the depreciation of raw materials and manufactures, the valuation of the stocks at the end of the financial year represented a loss of about 7,000,000 fr. on an ordinary share capital of 56,000,000 fr. It is stated that this is the first time during the 30 years' existence of the company that no dividend has been paid.

France.—Compagnie Continentale Edison.—The ordinary meeting approved the accounts for the year 1920, leaving a debtor balance of 65,666 fr. Taking into account credit carry overs from former years' working of 126,021 fr., a final balance of 60,508 fr. remained, which it was decided to carry forward. The Nevers installation during 1919 was in the preparatory stage, but developed in an encouraging manner in the course of 1920. In January only 161,588 kWh were sold, but by December that figure had risen to 496,202 kWh, the total for the year being 3,451,511 kWh. If the industrial conditions had not caused various important customers to restrict their operations considerably, the consumption of electricity would have more than doubled that actually attained. In 1920 the City of Paris carried out long experiments in the Vals-de-Loire district in deep pumping to tap underground water supplies, for which the company furnished the electrical equipment. The operations were completely successful and are still being continued. The report passed in review the position of the various undertakings in which the company has shares, namely, the Société Hydro-electrique de Lyon, the Société de Distribution de l'Electricité de l'Ouest, and the Compagnie Parisienne de Distribution de l'Electricité. An extraordinary meeting which followed sanctioned the raising of the capital from 10,000,000 to 25,000,000 fr. by the issue, on one or more occasions, of 30,000 500-fr. shares.

Tyneside Tramways & Tramroads Co.—The report for the half-year ended June recommends dividends at the rate of 5 per cent. per annum on the preference and 2 per cent. per annum (both less tax) on the ordinary shares; £500 to reserve and £140 carried forward. Increase in traffic receipts, £1,181.

City of London Electric Lighting Co., Ltd.—The directors have declared half-yearly dividends on the 6 per cent. first and 8 per cent. second preference shares; and at the rate of 10 per cent. per annum on the ordinary shares, all less tax.

Prospectus.—The list is due to close to-day (or earlier) in the issue of £750,000 in 6 per cent. debentures at 96 per cent., by the County of Southland Electric Power Board. The principal and interest are unconditionally guaranteed by the New Zealand Government.

Aberdeen Suburban Tramways Co.—Profit for the half-year ended July 31st £1,771, plus £3,808 brought forward. After putting £1,000 to renewals and depreciation, a dividend at the rate of 7 per cent. per annum is to be paid. £2,292 carried forward.

Oxford Electric Co., Ltd.—A dividend at the rate of 5 per cent. per annum, less tax, on the ordinary shares for the half-year is announced.

Clyde Valley Electrical Power Co.—An interim dividend at the rate of 5 per cent. per annum, less tax, is announced on the ordinary shares for the past half-year.

British Electric Transformer Manufacturing Co., Ltd.—An interim dividend on the ordinary shares at the rate of 6 per cent. per annum, less tax, for the half-year, is announced.

STOCKS AND SHARES.

Tuesday Evening.

The markets are not lacking in points of interest, although general business continues quiet. Money is said to be getting cheaper, but this may be a transitory matter: the usual tendency is for rates to stiffen as autumn approaches. Investment securities remain firm. The new General Electric 7 per cent. debenture is again better at 94½, a premium of 2 points, as against the discount of 4 to which it fell soon after allotment, when the stags were hastening to get out. Other new issues in this market are inclined to be irregular. North Metropolitan has risen to 7 premium, Metropolitan Electric Extension debenture is unchanged at 8 premium, and the Shropshire 7½ per cent. debenture weakened to 96¾, which is ¼ discount.

The Marconi report, given on p. 255 of last week's issue, caused a sharp drop, to 33s. 9d., in the ordinary shares. Support was quickly forthcoming, and a rally to 1 13/76 ensued. As announced here, the dividend on the ordinary shares is to be made up to 15 per cent. for the year, while the preference receive 12 per cent. This is a reduction of 10 per cent., in both cases, upon last year's dividends. Moreover, a bonus payment of 25 per cent., free of tax, was distributed a year ago, out of money received from the Government. It is interesting to trace the net profits record for six years, which stands as follows:—

1913	£122,300	...	...	1918	£597,900
1916	£318,400	...	...	1919	£1,220,740
1917	£383,800	...	...	1920	£297,682

Unfavourable rates of exchange are declared to be largely responsible for the shrinkage in the net profits. Because of these rates, substantial sums have been retained abroad on deposit, or invested in foreign Government securities. There are still outstanding claims against British Government departments, and it is difficult to appraise what may be the value of the shares from the standpoint of the permanent investor. The company has plenty of scope for expansion, in spite of the official "wireless chain." To the Stock Exchange eye, the shares retain attraction from the fact of their being a popular medium for speculation wherever there is "anything doing," which at present (save amongst investment stocks) there is not.

Following upon the payment of a healthy string of coupons upon Mexican Light & Power, Mexican Electric & Pachuca bonds, there comes the modest announcement that the March, 1915, coupon upon Mexico Tramways first mortgage bonds is to be met. Not much more than this had been anticipated. The price of the bonds is a little better at 54. The coupon, it may be useful to state, can be sold at £3 7s., less tax, in the Stock Exchange, whereas the company is paying, of course, only £2 10s. The Mexican Light & Power coupons can be sold at £37 5s. and the Pachuca coupons at £33, both less tax. British Columbia Electrics have gone back a little after their sharp rises last week, and Brazilian Tractions at 29 are ¼ up.

Electrical manufacturing shares are inclined to be heavy. Edisons have dropped 1s. 3d. to 8s. 3d. English Electrics are down 1s. 6d. to half-a-guinea. General Electric ordinary can be bought at £1. Other manufacturing shares manifest a similar disposition to dulness. The reason is that people are beginning to get a little afraid lest German competition may

become acute in this industry. To what extent the apprehension is justified, those connected with the business can judge better than a mere writer upon financial subjects, but it is certainly having its effect upon prices, and the market is a dull and somewhat heavy one.

The electricity supply group, however, is generally firm. County of London ordinary are ¼ up to 8⅝, though Charing Cross at 4¼ lost the half-a-crown improvement which they picked up a week ago. City of Londons at 1⅞ are unaffected by the interim dividend announcement of 1s. per share. Yorkshire Electric Power 5½ per cent. debenture stock has eased off to 84½. The prospectus of the Southland 6 per cent. debentures, at 96, guaranteed by the New Zealand Government is now out. As a matter of domestic interest, it may be mentioned that the bonds will be dealt in, not by the electrical market, but by jobbers in Colonial Government securities.

Changes in the cable market are few and insignificant. Great Northern Telegraphs have put on another 2s. 6d., but United River Plates, after the sharp advance they had enjoyed, lost 1/16 at 6½. Anglo-American Telegraph deferred is still being bought by the investor, and the price is better at 17¼. The Eastern group shows no alterations, except for a rise of ¼ in Globe preference.

Babcock & Wilcox remain steady at 2 7/16, while other engineering shares, together with those in the coal, iron and armament list, move narrowly, and, on balance, slightly downwards. Progress is being made this week with the formation of a new Rubber Shareholders' Association, and a preliminary meeting took place on Wednesday. The intention is to afford support to the proposals for enabling to be put into force a programme of further restriction of output, and control of the sale of the raw material. So far as market prices are concerned, however, these activities have had no influence in helping quotations. In fact, rubber shares are mostly lower on the week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price August 23, 1921.	Rise or fall.	Yield. £ s. d.
Home Electricity Companies.					
Brompton Ordinary	12	12	6	—	£10 0 0
Charing Cross Ordinary	7	8	4¼	— ¼	9 8 4
do. do. do. 4½ Pref.	4½	4½	8⅝	—	7 4 4
Chelsea	4	8	2¼	—	9 4 8
City of London	13	14	13	—	10 3 0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 0
County of London	6	8	8⅝	+ ¼	9 5 6
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 4
Kensington Ordinary	7	9	4¾	—	10 13 4
London Electric	2½	2½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	2⅞	—	10 9 0
Metropolitan	6	7	2⅝	—	9 6 8
do. 4½ per cent. Pref.	4½	4½	2⅝	—	7 16 0
St. James' and Pall Mall	13	13	6	—	10 0 0
South London	6	7	2⅜	—	10 13 2
South Metropolitan Pref.	7	7	15/9	—	8 17 10
Westminster Ordinary	10	10	6½	—	8 13 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	85½	—	7 0 4
do. Def.	1½	1½	17½	+ ¼	8 14 2
Chile Telephone	6	6	5½	—	5 14 3
Cuba Sub. Ord.	7	7	7¼	—	9 6 8
Eastern Extension	10	10	16⅜	—	6 2 9
Eastern Tel. Ord.	10	10	163½	—	6 2 0
Globe Tel. and T. Ord.	10	10	15½	—	5 19 8
do. do. Pref.	6	6	9⅜	+ ¼	6 8 0
Great Northern Tel.	22	24	24½	+ ½	9 17 6
Indo-European	10	10	30	—	6 6 8
Marconi	25	15	11⅜	—	8 5 6
Oriental Telephone Ord.	12	12	2⅛	—	*5 16 8
United R. Plate Tel.	8	8	6¼	— ⅛	*6 10 4
West India and Panama	Nil	Nil	6/8	—	Nil.
Western Telegraph	10	10	16½	—	*6 1 2
Home Rails.					
Central London Ord. Assented	4	4	49½	—	8 1 8
Metropolitan	12	12	25	—	6 0 0
do. District	Nil	Nil	17½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅝	—	Nil
do. do. "A"	Nil	Nil	6/6	—	
do. do. Income	4	9	70½	— 2	15 8
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	37	—	10 0 0
do. do. 2nd Pref.	Nil	5½	9⅜	—	10 0 0
do. do. 5 % Deb.	5	5	84	—	7 15 0
Brazil Tractions	Nil	Nil	1	+ ¼	Nil
British Columbia Elec. Rly. Pfce.	5	5	—	—	8 9 2
do. do. Preferred	5	4	55½	- 1	*8 11 2
do. do. Deferred	3		50	— ½	*10 5 4
do. do. Deb.	4½	4½	59½	—	7 2 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	54½	+ 1	Nil
do. 6 per cent. Bonds	Nil	Nil	25	—	Nil
Mexican Light Common	Nil	Nil	9	—	Nil
do. Pref.	Nil	Nil	17½	—	Nil
do. 1st Bonds	Nil	5	53½	+2	9 7 0
Manufacturing Companies.					
Babcock & Wilcox	15	15	2 7/16	—	6 3 0
British Aluminium Ord.	10	10	17/6	—	11 8 6
British Insulated Ord.	15	15	1 15/16	—	9 12 0
Callenders	15	15	1 7/8	—	10 8 8
" 6½ Pref.	6½	6½	17/8	—	7 8 7
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	8/8	-1/8	—
do. 5 per cent. Deb.	5	5	68	—	7 7 1
Electr. Construction	10	10	16/9	—	11 18 10
English Electric	8	8	10/6	—1/6	15 4 10
Do. Pref.	6	6	14/6	—	8 5 6
Gen. Elec. Pref.	6½	6½	17/6	—	7 13 0
do. Ord.	10	10	20/-	-9d.	10 0 0
Henley	15	15	1 5/8	—	10 5 0
do. 4½ Pref.	4½	4½	8½	—	6 18 6
India-Rubber	10	—	1⅞	—	—
Met.-Vickers Pref.	8	8	1 1/2	—	8 16 10
Siemens Ord.	10	10	1¼	—	*8 18 3
Telegraph Con.	20	20	21	—	*5 14 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, August 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	8½d.	..
a Ammoniac Sal	per ton	£65	..
a Ammonia, Muriate (large crystal)	"	£58	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£34	..
a Copper Sulphate	"	£31	..
a Potash, Chlorate	per lb.	6d.	..
a " Perchlorate	"	8d.	..
a Shellac	per cwt.	£14 10s.	£1 dec.
a Sulphur, Sublimed Flowers	"	£16	£1 dec.
a " Lump	"	£15	..
a Soda, Chlorate	per lb.	3½d.	½d. dec.
a " Crystals	per ton	£7	..
a Sodium Bichromate, casks	per lb.	7d.	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£90 to £975	£5 to £25 dec.
c Brass (rolled metal 3" to 12" basis)	per lb.	10½d.	
c " Tubes (solid drawn)	"	1/0½ to 1/1	½d. dec.
c " Wire, basis	"	11½d.	
c Copper Tubes (solid drawn)	"	1/3½	½d. dec.
c " Bars (best selected)	per ton	£101	£4 dec.
c " Sheet	"	£101	£4 dec.
c " Rod	"	£101	£4 dec.
d " (Electrolytic) Bars	"	£73	£2 10s. dec.
d " " Sheets	"	£145	..
d " " Wire Rods	"	£89	£2 10s. dec.
d " " H.C. Wire	per lb.	11 1/16d.	1/16d. dec.
f Ebonite Rod	"	3/6	..
f " Sheet	"	3/-	..
a German Silver Wire	"	2/9	..
h Gutta-percha, fine	"	13/7	..
h India-rubber, Para fine	"	1/1	1d. in.
f Iron Pig (Cleveland Warrants)	per ton	Nom.	..
f " Wire, galv. No. 8, P.O. qual.	"	£35	..
g Lead, English Pig	"	£24 5s.	15s. dec.
g Mercury	per bot.	£10 7s.6d.-£10 10s.	7/6 to 10/- dec.
e Mica (in original cases) small	per lb.	3d. to 3/-	..
e " " medium	"	4/- to 8/-	..
e " " large	"	10/- to 20/- & up	..
p Phosphor Bronze, plain castings	"	1/4 to 1/9	..
p " " rolled bars and rods	"	2/1 to 2/6	..
p " " rolled strip & sheet	"	2/3 to 2/7	..
d Silicium Bronze Wire	per lb.	1/3⅛	½d. dec.
r Steel, Magnet, in bars	"	1/8	..
a Tin, Block (English)	per ton	£149 to £150	£12 dec.
a " Wire, Nos. 1 to 16	per lb.	3/9	..
p White Anti-friction Metals	per ton	£65 to £275	£3 to £10 dec.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ——
r W. P. Dennis & Co.

Film Studio Lights.—The Departmental Committee appointed by the Minister of Health to investigate the causes and prevention of blindness, of which Mr. G. H. Roberts is chairman, has just issued an interim report dealing with the injuries to the sight of actors and actresses alleged to be due to the powerful lights used for the production of films in kinematograph studios. Complaints on this matter were made by the Actors' Association last year. The Committee traces the trouble to the use of open arc lights without diffusing screens, and finds that some transient eye injuries have thus been caused, but that there is no evidence of permanent damage to sight. It states that the evidence given is to the effect that unscreened arcs are not only unnecessary, but give less satisfactory photographic results, and the Incorporated Association of Kinematograph Manufacturers has given an undertaking to the Minister of Health that its members will not permit the use of open arc lights without filters in their studios. The committee accepts this undertaking, but points out that the industry is in a state of development, and that research is needed as to the best types of lamp for the purpose.—*Daily Telegraph.*

Fire.—There was an outbreak of fire at the premises of Mr. G. Blackburn, of Crown Street, Bolton, on August 19th, the cause being unknown. When the brigade arrived the building was well alight. Electrical appliances, valued at over £600, were destroyed.

Insufficient Foreign Postage.—The Postmaster-General draws attention to the fact that considerable numbers of insufficiently stamped letters are being sent through the post to places abroad, and more especially to the Continent. The prepaid rate of postage on letters for all foreign countries (except the United States of America and Tangier) is 3d. for the first ounce and 1½d. for each succeeding ounce or fraction of an ounce; from the United Kingdom to British Possessions generally, the United States, Tangier and H.M. ships and troops on foreign stations, the letter rate is 2d. for the first ounce and 1½d. for each succeeding ounce or fraction thereof.

LEAVES FROM AN INSPECTOR'S NOTE-BOOK.

By "ANODE."

One of the most disagreeable duties of an electrical inspector is in connection with the inspection of storage batteries, it being an extremely dirty and tedious undertaking, and in the majority of cases, any suggestions put forward for the maintenance of the battery are ignored, with the result that one sees a steady depreciation in its efficiency and performance.

Another point is that one's clothes are not benefited by sundry drops of acid being sprinkled upon them, and where the battery is situated at some distance from a station, it is not always possible to carry overalls, especially if burdened with a megger and other indispensable instruments.

It is really marvellous what a storage battery will stand up to in the way of bad treatment, and there is no doubt that battery makers generally can congratulate themselves on the superb qualities of their goods.

One of the best examples of how not to treat a battery came before me not long after I started out on the road, and being new to the job, and this my first battery inspection, I went into the matter very thoroughly and scientifically.

The first thing was a general look round, and from the appearance of the battery, I came to the conclusion that it was, and had been, out of use from time immemorial.

The attendant was a sort of combined groom-ostler-coachman-knife-boy-estate engineer generally, with a predilection for wisps of straw, those not in his hair being in his mouth, and I regret to say that he did not look a budding Faraday.

I asked this worthy whether the battery was ever used, and when did he think it was charged last, and to my astonishment he gravely informed me that it was in regular use, charged every day, and what was more, that it had been charged about twelve hours prior to my visit!

After a definite statement like this, I thought it better to get down to the job properly, and see exactly where we stood, and find out something definite about this happy battery.

The level of the electrolyte was extremely varied, in some cells the bridges being covered, while in others there were several inches of the plates uncovered; the density was all over the hydrometer, and in several cells so low that the hydrometer went straight to the bottom, giving me a nice job fishing it out again, to the detriment and soiling both of my suit and my soul.

The deposit in the cells in nearly all cases reached to the bottom of the plates, and reminded me of strata of multi-coloured sand, pointing to the fact that both the charge and discharge were extremely varied.

At the time of inspection there was no load on the battery, so voltmeter readings were of little, if any, use, the total reading being 115 for 55 cells.

Several cells were not in use, and in order to give these every chance when they were eventually taken out for overhaul by my G.O.C. friend, the attendant, instead of cutting out the defective cells simply short-circuited them with a piece of 19/16 cable.

I next turned my attention to the charging arrangements, and found that the dynamo and main switchboard were half a mile away.

The G.O.C. next took me to see the dynamo, and said he would now put the battery on charge. Simplicity itself; run the volts up to 150, slam the switch in, let it rip for four hours, and there you are! What more is wanted or required?

I was next shown the battery maker's record book, and this I found had been filled up daily, giving the density of electrolyte and voltage without any variation from the day when the makers handed it over; on asking how the G.O.C. accounted for the discrepancy between his and my figures, he quite candidly informed me that he filled the sheets up from the previous day's readings, and so back to page 1.

I took the G.O.C. into my confidence, and told him what he should do to get the battery back into decent condition as far as possible, especially pointing out the necessity and urgency of correcting the density of the electrolyte, all of which he promised faithfully to do. Yet on my next visit of inspection I found that all he had done was to top up the cells with water from a rusty tank.

Another battery that fell by the wayside was installed in a club, and was well and carefully looked after until on one unlucky day the gas engine broke down, and owing to the fact that a certificate could not be obtained (this was in the days of the great war) it did not appear that the battery was likely to be charged for some time. I visited the club about a month after the disastrous occurrence, and found the battery right down, and suggested that under the circumstances the best thing to do was to take the plates out, wash and dry them, and when the engine was repaired, to allow me to superintend the battery being recharged.

This was agreed to, but on calling round some months later, I found nothing had been done, the battery being by this time sulphated up. My advice was now asked for, and I suggested that the club committee should get into communication with the battery makers, and obtain a price for overhauling, &c.

But the committee, instead of giving the makers a free hand in the matter, sent for the local cycle and sewing-machine mechanic and asked him for his price and, needless to say, he quoted a considerably lower price than the makers and got the job.

On my next visit, I found the gas engine in full swing, but, unfortunately, the battery had been charged wrong way round. What should have been positive was negative and *vice versa*.

Again I informed the committee that the advice of the makers should be obtained without delay, but to crown all, they called in the sewing-machine mechanic who just ran the battery down, and charged up again in the opposite direction. The result was that the plates shed 75 per cent. of their active material, and in the end the committee had to install a new battery at war prices. Serve 'em right.

A peculiar case of battery trouble occurred at a brewery situated not a hundred yards from this club.

The battery was apparently of ample capacity for its work, was well erected and maintained, properly charged and looked after, yet for some reason the plates were continually buckling and shedding their active material, and it was quite by accident that I found the cause of the trouble.

I happened to miss my usual train on one occasion, and as it was a wet day I decided to remain on the brewery premises till the next train went, in about a couple of hours or so.

I filled in my time as best I could going over my notes, and about an hour after the regular staff had gone, the watchman suggested that I should partake.

Needless to say, the offer was accepted, and he led the way to the lift, which in due course landed us up in the regions where the bottling was done. After I had partaken, I had a brain wave, and asked the watchman to take me to the bottom again. I then asked him to take the lift up and down a few times while I remained in the power house. I found that the lift took 60 amps. at 110 volts, and this was the cause of the trouble, the battery being only of 200-Ah capacity.

Still, all batteries do not get this class of treatment, and I know of one battery which gave 18 years' continuous service, and was then in good condition, and was only put out of service owing to the fact that the local supply company ran a main out to the estate. This battery was cared for by a first-class type of man, not

an electrician by any means, but a man who was content to do what he was told, and do it thoroughly.

In circumstances like these, a battery will do all, and more, than the makers claim for it, and as I said at the beginning, "it is really marvellous what a storage battery will stand up to in the way of bad treatment."

WORKING CONDITIONS IN FACTORIES.

Report of H.M. Inspector of Factories.

(*Concluded from page* 241.)

Industrial Diseases.—It is recorded that the total reported cases of lead poisoning during the period under review numbered 243 [22] * (the 1919 figures being 207 [26]), of which 47 [2] cases occurred in the electric accumulator industry (the 1919 figures for which were 48 [3]).

The figures for electric accumulators continue to be the highest. The principal chemist of the Government Laboratory was asked to assist by determining the amount of lead fume and dust given off in lead burning and chemical plumbing in this industry. An interesting inquiry followed, and after tabulating several estimations made of lead fume and dust, with knowledge of the processes and of the incidence of lead poisoning in them, it was concluded that if the amount of lead present in the air breathed contains less than five milligrammes per 10 cu. m. of air, cases of encephalopathy and paralysis would never, and cases of colic very rarely, occur. And this figure is a quite practical one to expect in any process amenable to locally applied exhaust ventilation. Somewhere about two milligrammes of lead are regarded as the lowest daily dose which (inhaled as fume or dust in the air) may, in the course of years, set up chronic plumbism. Arranged in this way the figures given in the report show that in experiments in lead burning and wire brushing in smoothing the lugs and in the pasting room, the standard laid down is considerably exceeded. The experimenters, moreover, said: "It is probable that the air breathed is richer in lead than that drawn through the apparatus. It would be very difficult—if not impossible—under ordinary working conditions to catch and trap in the apparatus all the lead rising from the burning operations."

There were five cases of mercury poisoning; two in the manufacture of clinical thermometers, one in the testing of electric meters (the only case in this factory for many years past, occurring during alterations to the premises when the exhaust fan was out of use), one in the manufacture of corrosive sublimate, and one of a man employed as an electrode cleaner in the manufacture of caustic potash and bleaching powder by electrolysis.

Dermatitis in electro-plating works has also been investigated and is largely due to the lime and caustic solutions used in the preliminary processes of cleaning.

Investigating a complaint of vesicular dermatitis among women electro gilders, it appeared that the contact with the wire carrying the very weak current set up the primary skin irritation, as it was chiefly limited to the inside of the fingers coming in contact with the wire.

The Medical Inspector of Factories was asked by a coroner to assist in determining the cause of a condition of the skin found after death. The deceased was in charge of a small electrical station supplying an institution, and on the evening of his death had complained of not feeling well, attributing this to a commencing attack of malaria. About midnight he was found lying dead on the floor of the station, and at the inquest medical evidence showed that there was heart disease sufficient to account for sudden death, but attention was directed to a condition of the skin simulating burns which it was thought might have been caused by electricity. The skin showed a condition not unlike a superficial burn but without any surrounding inflammation, the superficial layer of the skin being removed as though by vesication and subsequent rubbing. Apart from its superficial character, the area was too extensive to admit of the possibility of an electric burn, and this opinion was subsequently endorsed by the Electrical Inspector of Factories, who found the pressure of the electric current in the plant too low to produce even a slight shock. The deceased had in falling upset a hurricane lamp containing paraffin and on examining the clothes—which had remained on the body for five or six hours after death—it was found that the parts corresponding with the affected skin areas were saturated with paraffin. There was no indication of the clothing having been burnt either by acid or heat, and the condition, it is considered, was produced by the prolonged action of the paraffin on the skin.

Electric Arc Welding.—During the year Dr. Bridge completed an inquiry with Mr. Scott Ram into the danger to the eyes of workmen employed in the process of electric arc welding. As a clear view of the work is required in order to strike the right place with the arc, and skill is necessary so that the screen used to protect the eyes may be interposed at the right moment, learners suffer more than experienced men.

The symptoms, which occur from four to eight hours after exposure, are a feeling of sand in the eyes accompanied by intense pain, conjunctivitis, photophobia, lachrymation, with blurring or temporary loss of vision. Severe headache is also frequently experienced. These symptoms gradually subside, the time varying according to the intensity, and length, of exposure to the arc, recovery being generally complete in from 24 to 48 hours.

Dr. Bridge found no evidence of permanent scarring of the cornea, such as might have been produced by a previous keratitis. It is, however, possible that with inflammation and abrasion of the superficial layers of the cornea the ulceration would leave a permanent scar.

The rays also affect those parts of the skin which are exposed, and the effects closely resemble a severe sunburn, the skin peels, and recovery is complete. Slight pigmentation of the skin has been observed on those who have been affected, but no evidence of ulceration or cell proliferation has been seen. The length of exposure to the rays necessary to produce the eye symptoms described above is difficult to determine accurately, but is very short and may be calculated in seconds (a flash being sufficient) so that, when the symptoms occur, the man is said to have "caught a flash." It is for this reason that the difficulty of providing full protection is increased, for a man passing from one place to another where electric welding is in progress, may receive a flash as he passes; or again, two welders working near one another may receive side flashes from each other's work unless they are carefully screened. The exact distance at which it is safe to receive a flash or to look at the arc when the work is in progress is also difficult to estimate, but at a distance of 15-20 feet a flash does not appear to produce symptoms, in fact, at this distance the arc itself can be looked at for a few seconds. A longer exposure at this distance, however, possibly might produce symptoms.

Dr. Bridge obtained no evidence that permanent injury to the eyes resulted from exposure to the rays produced by electric welding. Electric welding has not been carried on in this country to any great extent until the last few years, and therefore the number of men exposed for any length of time in the past has been few. It was suggested that cataract might be produced by the rays given off from the arc. Here again, the length of time in which the work has been in operation in this country is short, and while it is too early to state positively that cataract (a disease of slow growth) will not occur among electric welders, there are essential differences in this occupation and that of glass workers which is known to produce cataract, both in the rays which affect the eyes and the length of exposure to them, which makes this highly improbable. Experiments would seem to demonstrate clearly that cataract is not produced by the light from welding or from flashes from a short circuit, but that it may follow injuries by short circuit when the current passes through the body of the injured person. The flash which frequently accompanies a short circuit is the explanation of cataract being produced by the light.

The precautions taken in all the works visited were very much on the same lines and generally consist of a hand screen to protect the face and eyes, and gloves or gauntlets to protect the hands. The hand screen, which is sometimes of metal and, therefore, offers certain dangers from contact with a live cable, is provided with a handle and with a window of coloured glass, an effective combination being a ruby glass between two blue glasses. Such a combination of coloured glass is practically opaque to ordinary light, but the molten metal and the point of the electrode when the work is performed can be seen clearly through it. Helmets of various types have also been seen, and have the advantage of screening the worker from side flashes from the arcs of adjacent welders on either side. A similar protection is afforded in a simpler manner by providing, in addition to the screen, ordinary clear glass spectacles fitted with side pieces which have the additional advantage that they protect the eyes when the slag is chipped from the weld.

To protect the hands and arms, gloves or gauntlets are generally provided, and where the cuff of the shirt is brought down over the glove and fastened, burning of the skin is avoided. In certain situations, such as work overhead, protection is required against falling particles of molten metal. Leather capes and leather aprons afford good protection.

* Principal figures refer to cases; the small ones to fatal cases.

The Batti-Wallahs Look Ahead.—The Committee of the Batti-Wallahs has been discussing provisional arrangements for the winter of 1921 and the summer of 1922. The proposals include the monthly luncheons, four informal gatherings, a ball, a smoking concert, golf, tennis, billiards, and snooker competitions, a summer outing, and an annual dinner. Members are at present being circularised by Mr. Greenly, the hon. entertainment secretary (37 and 38, Strand, W.C. 2), asking them to make their wishes known regarding these events, also to indicate the amount of support that they are likely to be able to give. Only one smoking concert is proposed (as last year) as the attendances have not been sufficient to cover the cost. The Batti-Wallahs' quarterly *Journal* may be revived if sufficient support is forthcoming to cover the cost.

THE SUPPLY OF ELECTRICAL ENERGY IN BIRMINGHAM AND DISTRICT.

By FRANK FORREST, M.I.E.E.

(Abstract of paper read at the Birmingham & District Electric Club *by the chief assistant electrical engineer of the City of Birmingham Electricity Department.)*

Just prior to 1914 the equipment of the Summer Lane station was completed, and work had already been commenced upon the foundations of a proposed new generating station at Nechells, which was designed for an ultimate capacity of 100,000 kW. Immediately upon the outbreak of war, however, work in connection with this new generating station was stopped at the request of the Government. By the end of 1914 the department was faced with a rapidly increasing load which, in the national interests, had to be supplied at the earliest possible moment. As it was clear that if work was resumed on the new permanent station it would be at least two years before it could be put into operation, the Electric Supply Committee decided to erect a temporary generating station with a plant capacity of 10,000 kW.; this station started work in 1915, within the record time of nine months from the date when it was commenced. It, however, proved quite inadequate to meet the ever-increasing demand for electric power, and extensions were taken in hand, bringing the total plant capacity in this station up to 22,000 kW.

As the demand for war purposes still continued to grow (it increased from 73,000,000 to 160,000,000 units in four years), in 1917 arrangements were made for the Dunlop Rubber Co. to supply an additional 9,000 kW; even with this assistance it was necessary to restrict all new connections and to run the plant practically without any stand-by at times of heavy load.

After the war was over, the demand very soon began again to increase, and last winter it was roughly 14,000 kW in excess of the highest war demand.

Shortly after the armistice was signed, work was again commenced on the Nechells permanent station, and this is being pushed on with all possible speed. Unfortunately, however, largely owing to the moulders' strike, but also to the slow rate at which work is now carried out, very serious delays have occurred, with the result that it will not be until the end of the current year that the first section of this station, totalling 30,000 kW, will be ready for running. A strong recommendation was recently made to the City Council to sanction the installing of a further 30,000 kW, bringing the capacity of this station up to 60,000 kW. Unfortunately the financial stringency of the times made it necessary to rule out this extension, but it has been decided to install an additional 5,000-kW set next year to tide over until money is easier.

At the rate of increase that is anticipated during the next few years it is pretty clear that the ultimate capacity of the Nechells permanent station, viz., 105,000 kW, will all be taken up within a measurable period of time, and in order to make still further provision for the future a large site has already been acquired close to the Midland Railway, between Water Orton and Whitacre, where there are ample facilities for a station having, if necessary, an ultimate capacity of 1,000,000 kW. The position of this site, being so close to the large industrial demand of Birmingham and district, should ensure a supply being given at a more economical figure than could be obtained from a super-station at a greater distance.

Nechells Temporary Generating Station.—This station was built in the yard of the dust destructor close to the site of the permanent station, it being realised that by doing this, the feeders supplied from this station could be most economically and easily transferred to the permanent station next door when the time came for shutting it down. The comparatively small space available made it necessary to put up two distinct boiler houses and turbine houses; the cooling-tower equipment also had to be erected in two sections.

No. 1 turbine house contains two 5,000-kW turbo-alternators and surface condensers installed by the Metropolitan-Vickers Electrical Co.; No. 2 turbine house contains two 6,000-kW turbo-alternators installed by the British Thomson-Houston Co., with surface condensers by Messrs. Worthington-Simpson, Ltd.

All these turbines run at a speed of 1,500 revolutions per minute, and the alternators generate three-phase, 25-period energy at a pressure of 5,000 volts between phases.

A complete set of circulating water, air, and water extraction pumps, each driven by a small steam turbine, is installed in connection with each condenser. These small turbines run at a very high speed, and are geared down through special gearing so as to enable the pumps to run at a lower speed.

The two boiler houses contain 12 marine-type water-tube boilers, by Messrs. Babcock & Wilcox, fitted with chain-grate mechanical stokers and superheaters. The steam pressure is 200 lb. per square inch, and the steam is superheated to a total temperature of 700 deg. F. Induced draught is supplied to these boilers by means of the "Prat" system.

No economisers are installed, but feed-water heaters are arranged to utilise the exhaust steam from the station auxiliaries, and in this way the temperature of the feed water is raised to 180 deg. F.

The overhead coal bunkers are supplied by electrically-driven overhead telphers, made by Messrs. Herbert Morris, Ltd. The circulating water is pumped through the condensers and through a system of wooden cooling towers. The make-up water required to replace that evaporated in the towers is obtained from the effluent that is discharged from the bacteriological filter beds on the sewage farm. This effluent is practically free from germs when it is obtained, and after it has been once through the cooling towers, it is sufficiently aerated and purified to remove any trace of germs that may be in it. Exhaustive tests have been carried out which prove that no deleterious effect is caused by the use of this water. At the same time it is found that the nature of the effluent is such that the condensers are kept absolutely clean by its use; no scale formation takes place in the tubes, and no corrosion of any kind is set up.

The station is built upon a ferro-concrete raft upon the surface of the ground. The structure itself consists only of a steel framework covered with corrugated asbestos sheeting, which is the lightest construction that could be obtained for the purpose.

Nechells Permanent Station.—In the scheme, this station is laid out for an ultimate capacity of 100,000 kW. It will comprise an engine house and boiler house located side by side, with a switch house built out at one end of the engine house.

The nature of the soil on this site is poor, and it was decided to drive ferro-concrete piles into the hard subsoil about 12 or 15 ft. down. These piles are arranged either singly or in groups to take the concentrated loads of the steel structure, whilst ferro-concrete beams are constructed between, which form the footings of the brick walls which are filled into the steel structure.

The initial installation in the turbine house will consist of two British Thomson-Houston 15,000-kW turbo-alternators supplying three-phase energy at 5,000 volts, 25 cycles, running at 1,500 r.p.m. The surface condensers are by Messrs. G. and J. Weir, Ltd.

The boiler house will be divided up into sections, each section containing six boilers, a total of twelve boilers being put in for the first instalment. These boilers are of the Babcock & Wilcox marine pattern, each being capable of evaporating 40,000 lb. of water per hour from and at 212 deg. F. They are equipped with balanced draught mechanical chain-grate stokers, and with superheaters, and supply steam at a pressure of 325 lb. per sq. in. at a total temperature of 700 deg. F.

An overhead steel tube economiser is fitted to each boiler, the boiler and economiser acting as one unit.

The boilers are being set 2 ft. higher than the standard setting, in order to allow of ample combustion space between the boiler fire and the bottom row of tubes. This is found to be of great advantage in obtaining perfect combustion and mixing of the furnace gases before they reach the comparatively cool surface of the tubes.

Forced-draught fans are installed in the basement of the boiler house, one fan for every line of three boilers, and these deliver air under pressure into the closed ash pits of the mechanical stokers. The air that is used for cooling the windings of the main alternators and which becomes heated in this operation is led to the suction of these forced-draught fans, so that the heat dissipated from the alternators is utilised in the boiler fires.

Overhead coal bunkers are provided in the boiler house, which are fed by electrically-driven overhead telphers. These telphers can draw their coal by means of grabs either from pits external to the boiler house into which the railway trucks are discharged, or from canal barges lying in the private canal basin, or from a coal store on the far side of the canal basin.

One electric telpher is provided for each line of three boilers, and by means of switches in the overhead runways it will be possible to interchange telphers between one boiler house and another, should this be necessary.

At the high duty at which this modern type of boiler works, viz., an evaporation of about 8 lb. per sq. ft. of heating surface per hour, it is necessary to ensure that the internal tube surfaces are kept absolutely clean and free from scale. Water with practically no hardness in it, therefore, has to be used, and it is found that when this is done, internal corrosion of the feed pipes and economisers is very liable to take place. This corrosion is largely due to the presence of air and carbonic acid gas in the water, and arrangements have, therefore, been made, as far as possible, to prevent the feed water coming in contact with the air. The make-up water before it is introduced into the system is subjected to a vacuum in order to extract the air from it, and the combined condensate and make-up water on its way to the suction of the feed pumps is passed through a de-aerating heater. In this way the large quantity of air that is usually pumped into the boilers with the feed water will be, as far as possible, kept out of the system, and internal corrosion will be eliminated.

The large cooling-tower reservoir will be divided up into sections, and a certain number of wooden cooling towers will be erected over each section. Each turbo-alternator has its own circulating water pumps which draw the water from these reservoirs, pump it through the condensers, and on to the cooling towers. The suction of each pump is distinct, but the deliveries go into a common header from which connections are taken to each tower. The evaporation can be made up from three sources: (1) The effluent from the bacteriological filter beds on the sewage farm; (2) the discharge from an artesian well which has been sunk on the site, and (3) the town water supply. The first of these will normally be used, whilst the second will be run every day in order to keep the artesian well in working order, the third being kept as a stand-by.

A large area of ground to the north of the station has been reserved for coal storage. The final arrangement for handling the coal into and out of this store has not yet been decided upon.

The switchgear which is contained in the switch house, and which controls both the main turbo-alternators and the outgoing circuits, is all arranged to be operated from the control room by means of electrical connections. This room is being arranged so that the operator in charge of it is really in control of the whole electrical system throughout the city. A diagram of every high-pressure main and connection will be kept in this room, showing every switch controlling either a generator or a circuit. Whenever a machine or a circuit is switched in or out, or whenever any alteration is made in the distribution system outside the station, the information will at once be given to the operator, who will reproduce it on the diagram. He will then be able to see at a glance exactly how the load is being distributed throughout the system, what machines are carrying it, and at the same time he will be kept informed of the amount of load that has to be dealt with. Any disturbances, breakdowns, or other occurrences will be immediately reported to him, and he will have to decide what steps have to be taken either to restore the supply if it is interfered with, or to readjust the load between the various stations. The operator in this control room, therefore, really acts as a " load dispatcher " in a somewhat similar way to a load dispatcher on a railway system.

Extra-high-pressure energy will be supplied from this switch house, partly at a pressure of 30,000 volts between phases and partly at a pressure of 5,000 volts between phases. The 30,000-volt energy will be stepped up by means of groups of transformers installed in the switch house from 5,000 to 30,000 volts. Each 30,000-volt circuit will have a capacity of 10,000 kVA, and the trunk cables will be run to various centres in the town, where the energy will again be transformed down to 5,000 volts for distribution in the district.

The rotary converters in the sub-stations are divided into two sections, one for the supply of traction power at 550 volts and the other for low-pressure lighting and power supply at 440 volts between the outer conductors of a three-wire network.

Storage batteries are installed partly to carry the peak load in the winter afternoons, and partly to float on the lighting busbars in order to maintain a steady voltage. End-cell regulation is provided on these batteries in order to meet the variation in the busbar voltage which is required at different times of the day.

The low-pressure direct-current cable network supplies from each of the generating stations and sub-stations are isolated from one another, so that a disturbance in one area will not affect the supply in any other area. The low-pressure traction supply is divided up in the same way, but in both cases means are provided for connecting stations together through the low-pressure network, should this be necessary at any time.

The extra-high-pressure supply to large consumers is given by means of ring mains, which can be controlled at the generating stations and sub-stations, and the switchgear and mains are so arranged that any consumer can be fed from either of two stations or sub-stations.

The Birmingham Corporation electricity supply undertaking up to the present has been practically confined to the area contained within the city boundary; it is, however, probable that in the near future Birmingham will not be allowed to remain in isolation.

The West Midlands area delimited by the Electricity Commissioners, which affects the Birmingham district, includes the four counties of Shropshire, Staffordshire, Warwickshire, and Worcester. By far the larger portion of the demand in this area—about 85 per cent.—will be concentrated in the industrial district comprising Birmingham, Wolverhampton, and the Black Country, whilst other towns such as Nuneaton, Coventry, Rugby, Warwick, Leamington, Redditch, and Worcester, added to any demand required in the agricultural district, will account for the balance.

Wolverhampton, Walsall, West Bromwich, and the Midland Electric Power Corporation supply current at 50 cycles per second, whilst Birmingham and the Shropshire, Staffordshire, and Worcestershire Power Co. supply 25-cycle electricity. It is a very difficult and expensive matter to make such energy interchangeable in any quantity. In all probability, therefore, the Birmingham district will be divided up into two sections, one with a supply at 50 cycles and the other at 25 cycles per second.

A proposal is already on foot to combine the 50-cycle undertakings into a Joint Authority under the new Electricity (Supply) Act,* and it is suggested that large power stations should be erected at Rugeley and Stoke on the river Trent, and at Ironbridge on the river Severn. These sites are situated a considerable distance from the centres of demand, but energy will probably be transformed to a very high pressure and transmitted by overhead trunk lines.

For the two 25-cycle undertakings, that is, Birmingham and the Shropshire, &c., Power Co., Birmingham is already building a large station at Nechells, and has obtained a further site for a station of a still greater capacity at Hams Hall, close to Water Orton on the Midland Railway. The Shropshire Power Co. has already developed plans for erecting a large power station at Stourport on the river Severn. These sites are much nearer to the great centres of demand, and the cost of transmission will, therefore, be considerably less than for the 50-cycle section. At the same time, Nechells and Hams Hall will be obliged to use cooling towers for condensing purposes instead of river water, and the extra cost of this will be a set-off against the lesser cost of transmission. The net result to the consumers, therefore, should be very much the same in both cases.

At the Hams Hall site, which has an area of a thousand acres, it will be possible to obtain a very large quantity of the effluent from the bacteriological filter beds on the sewage farms. About 25 million gallons a day are at present running from these beds into the river Tame, and this quantity, if utilised in cooling towers, could easily provide the make-up required by the evaporation in the towers for a station capacity up to one million kilowatts.

The site is also situated very conveniently for three coalfields: The Cannock Chase district; the Nottingham and Derby district; and the Warwickshire and Leicester district.

The Stourport station on the river Severn could easily develop 100,000 kW by using the river water through the condensers, without the necessity for installing cooling towers. For a greater capacity, cooling towers will probably be required during dry seasons.

In the future, in all probability, Stourport, Nechells, and Hams Hall will be linked-up by means of heavy trunk mains, so that the spare plant in one station can be made available for assisting another in case of emergency. In this way great reliability of supply given from these stations should be obtained.

It will probably be a good many years before the whole of this scheme is brought into being.

A commencement has already been made at the Nechells station, and an early start is contemplated with the Stourport station. The development of the scheme will proceed gradually but on bold lines, in order to meet the gradual growth in the demand.

A recent estimate that has been prepared of the requirements in the district goes to show that from nine hundred thousand to one million kilowatts will be required in the Birmingham and district industrial area. This will, of course, take some years to develop, but it must be regarded as certain that it will be required sooner or later, and the plans for dealing with the district will have to be developed with this end in view.

THE MAGNETIC PROPERTIES OF MONEL METAL.

During recent years monel metal has come to be used quite extensively. It is a useful nickel-copper alloy which has definite magnetic characteristics that are well below those of soft iron, but the critical temperature at which it becomes non-magnetic is very low, near the boiling point of water—a property which should make the metal of importance for such use as in relays for temperature-control equipment. Moreover, monel metal resists corrosion, and is tough, strong, and elastic.

In view of its growing importance, and the complete lack of information concerning its magnetic properties, the results of an investigation of the magnetic nature of monel metal, as communicated to the *Electrical World* by Mr. C. W. Burrows, are of interest. The material used in the experiments was the standard product regularly supplied commercially by the International Nickel Co., and an analysis of the samples tested showed the following average percentages: Ni 65.636, Cu 29.37, Fe 1.13, Mn 1.178, C 0.16, Si 0.376, S 0.0318.

The samples of monel metal were examined magnetically by placing them in the uniform field of a long magnetising solenoid and suddenly withdrawing them therefrom. The resulting change in magnetic flux threading the small detector coil which at the beginning surrounded the metal portion of the test bar was indicated by the ballistic deflection of a galvanometer, and this quantity, added to the strength of the magnetic field as determined by a separate measurement, gave the true induction in the specimen. Full induction curves of typical samples are shown in fig. 1, while fig. 2 illustrates the relative magnetic characteristics of monel metal and the usual magnetic materials.

* Elec. Rev., August 5th, 1921.

The critical point was determined by placing a small slug of the material under test in a beaker of paraffin, at a temperature differing only slightly from that of the paraffin, to pass through the critical temperature. During this operation the slug was repeatedly tested with a small pointed electromagnet, and the temperature at which the magnetic change occurred was noted. In the samples tested there was no appreciable difference between the temperature at which the magnetisability of the material disappeared on heating and that at which it reappeared on cooling. The average critical point for a number of sheet and rod samples, hot and cold rolled, was 203 deg. F., compared with 670 deg. F. for nickel, 1,440 deg. F. for iron, and 2,000 deg. F. for cobalt.

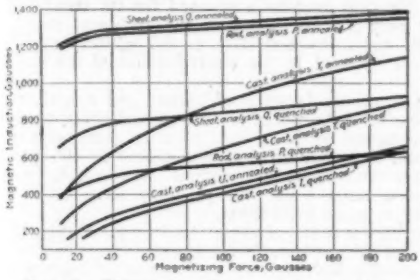


Fig. 1.—Magnetic Data of Monel Metal.

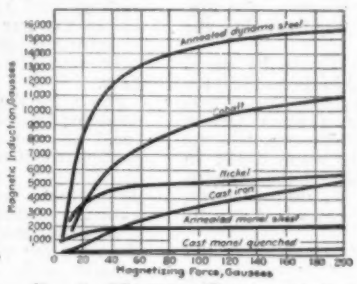


Fig. 2.—Magnetic Characteristics of Various Metals

Experiment showed that the heat treatment which produced the lowest permeability in monel metal consisted in heating to a temperature of 1,300 deg. F., cooling slowly to 350 deg. F., and finally quenching in brine at 16 deg. F. The highest permeability resulted from furnace annealing at approximately 1,300 deg. F. The influence of hot working upon the magnetic properties of monel metal is shown by a comparison of the magnetic results obtained from cast and hot-rolled materials. The former in the annealed state exhibits the lowest induction, annealed hot-rolled sheet shows the highest permeability, and hot-rolled rods take an intermediate position. In general, the effect of hot working is to increase the magnetic softness of monel metal, the cast metal being the hardest magnetically, and sheet which has received a maximum of hot working, the softest.

Table I.

Magnetising force.	Change in permeability.
1	100 per cent. increase.
2.5	17 per cent. decrease.
5	27 per cent. decrease.
10	29 per cent. decrease.
25	28 per cent. decrease.
50	28 per cent. decrease
100	14 per cent. decrease.
200	12 per cent. decrease.

Cold working changes the magnetic characteristics of monel metal. For large magnetising forces the magnetic changes are similar in nature and magnitude to the corresponding ones in the properties of steel. To determine the effect of cold working, a 10-in. rectangular bar of monel metal was hammered while cold until it increased 2¼ per cent. in length; Table I shows the relative change in permeability between the original specimen and the hammered bar.

THE LIGHTING OF FACTORIES AND WORKSHOPS.

Second Home Office Report.

In January, 1913, the Home Secretary appointed a (Home Office) Departmental Committee to inquire into and report on the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the workers employed, and the various forms of illumination. In 1915 the Committee issued its first report * dealing with the general lighting of factories, and further inquiry was then postponed until the termination of the war. In November, 1920, the Committee resumed its work, but owing to the urgent need for economy it has since been found necessary to restrict its inquiries. Nevertheless the Committee has issued a second report† on the conditions necessary to secure suitable artificial lighting, and recommends certain requirements which if applied to all factories and workshops will, in its opinion, ensure that artificial lighting shall be suitable for its purpose. Moreover, the Committee promises to report separately, in due course, on the subjects of mixed natural and artificial light, classification of processes according to the minimum illumination required, &c., and to investigate other lighting effects.

In its present report the Committee deals only with the problems of suitable *artificial* lighting, and states *inter alia* that some misconception and ignorance of these problems exist, and that unsuitable systems of lighting are still common in factories and workshops. This condition has been accentuated recently by the extending use of high-intensity gasfilled electric lamps, which in many instances are used to replace tungsten lamps in shades and reflectors intended for the latter, whereas to maintain suitable lighting, change of type of lamp often necessitates change of type or readjustment of the shade.

The requirements of suitable lighting are quite definite, they are: Absence of glare and of troublesome shadows, a steadiness and constancy of the light source, together with a moderate degree of uniformity of illumination and of surface brightness over the plane of work. Certain other factors bearing on suitable lighting are:—

1. Diversity, *i.e.*, the ratio of maximum to minimum illumination. This is closely related to adequacy, since upon the maximum illumination depends the extent to which the illumination may fall before it becomes inadequate.

2. Contrast due to difference of surface brightness. Further experiments may show that some regulation as to the surface brightness of any two visually contiguous surfaces may be required.

3. Colour and composition of the light. The introduction of new high-intensity light sources of different types may, eventually, make it necessary to consider how far this factor affects the suitability of lighting, but no requirement dealing with this point is called for at present.

Glare.—The term "glare" covers the effect (*a*) of looking directly at a bright source of light so that the observer is for the time being dazzled and his vision is impaired for a short period after the light has ceased to enter his eye; (*b*) produced by the presence of one or more bright sources of light towards the edge of the field of vision so that the rays enter the eyes obliquely from them. An observer may never look directly at such sources of light, but he is nevertheless troubled by their presence near to the object at which he is looking. This is the commonest form of glare; (*c*) produced when the surface of the material being worked upon is shiny or polished, and reflects light directly from some source into the eyes of the worker, causing work with such materials to be very trying unless the worker is so placed with reference to the source of light that none of the rays can be directly reflected from the material into his eyes.

All three forms of glare are still to be met with in factories. The possible effects of the first two (which are most commonly due to absence or imperfect protection of the light sources) are twofold. Discomfort may be caused to the worker by the presence of a strong light in or near his line of vision, or a worker or other person entering a room may be temporarily dazzled by the light, so that he is unable to see his way about, and may incur additional risk of accident.

The first essential of suitability, therefore, is *proper* shading of the light sources. The effect of a shade is to reduce the intrinsic brilliance of the source, and proper shading could accordingly be defined by the simple criterion whether the incandescent filament, mantle, or flame, is distinguishable as such when viewed through the shade.

So far as glare is concerned, the source need only be screened when in or near the direct line of vision, and then only in the direction towards the eye; accordingly the framing of a requirement which, without insisting on complete screening of the source, will ensure that no bright surface is visible except when considerably away from the usual line of vision, takes two factors into consideration: (1) The distance of the source from the eye; (2) the angle at which the light from an unscreened or improperly screened source may enter the eye without producing objectionable glare.

(1) If an unscreened source is situated beyond a certain distance, which for all sources commonly employed in factories may be taken as 100 ft., its apparent size and the amount of light entering the eye will be so small as to render the glare effect much less evident, and any such sources may be excluded from the requirement which we propose.

(2) Conversely, as the distance between the eye and the source decreases, the apparent size of the source and the influx of light from it will increase, and glare can then only be avoided by screening the source or by increasing the angle between the central line of vision and the source.

Therefore, in practice a suitable requirement might be expressed in terms of the distance of the source and of a limiting value of the angle between the line from the source to the eye and a horizontal plane, within which angle no such source should be directly visible. In the case of sources used for general lighting for the purpose of a legal requirement, the limiting value of the angle specified should be 20 deg., but in the case of very near sources, such as are employed for local lighting, an angle of 30 deg. should be substituted. The Committee accordingly recommends that there should be a provision as follows:—

* Cmd. 8,000. Elec. Rev., Sept. 17th, 1915; p. 356.

† Cmd. 1,418. H.M. Stationery Office, Kingsway, W.C. 2; price 1d. net.

". . . Every light source (except one of low brightness*) within a distance of 100 ft. from any person employed shall be so shaded from such person that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20 deg., or in the case of any person employed at a distance of 6 ft. or less from the source, not less than 30 deg."

The third form of glare (which is common in factories where smooth or polished material is used) is generally caused by unsuitable placing of the source, and may be remedied either by changing the position of the source relatively to the eye, or by increasing the diffusion of the light by enclosing the source in some diffusing material.

Shadows.—Troublesome shadows (frequently to be found even with systems of lighting which are good in themselves) are generally due to unsuitable placing of the light sources, whereby the shadow of the worker himself or of some part of the plant or material is cast on the place of work, and are particularly objectionable when thrown by some object in motion. Apart from the annoyance caused and the interference with the proper execution of the work, deep shadows, by concealing dangerous parts of machinery, may lead directly to accidents.

Constancy.—Constancy in artificial illumination is a matter of great importance. Unsteadiness and flicker have an injurious effect on vision, and if pronounced, increase the risk of accidents. Therefore, flicker which can be remedied should be prohibited.

In arriving at the above conclusions the Committee considered the codes of lighting which have statutory force in many of the American States and the recommendations for industrial lighting formulated by the Illuminating Engineering Societies of America and Germany.

* By "low brightness" is meant an intrinsic brilliance of not more than five candles per sq. in.

HOPEFUL SIGNS IN AUSTRIA.

Vienna hopes fervently to resume her position as an important intermediary of exchange between Middle and Western Europe on the one side and the Near East on the other. The time when that hope may be fulfilled seems remote, and other cities in the reconstructing States are competing for the place—Budapest, her old rival, Belgrade in the new and rapidly-reviving Serb-Croat-Slovene Kingdom, and last, but not least, Prague, in Czecho-Slovakia.

Vienna's chances have recently been improved by the arrangements which are being made for Austria to enter into the advantages of the Ter Meulen credit scheme. They would, of course, be improved, too, by the economic recovery of Russia, but that contingency is also remote. H.M. Commercial Secretary at Vienna says, in his recent report, that the Austrian capital must inevitably lose some of the business it has hitherto done, to the merchants, banks and insurance houses in the capitals of the other Succession States. Moreover, the head offices of most of the important Bohemian undertakings are already being removed to Prague. Yet, in spite of all, there is no doubt, in the Commercial Secretary's view, that Vienna will remain the most important city in that part of Europe.

The new Austria presents several features of interest to the engineering trades. In the Erzberg, Styria, it possesses one of the most valuable iron deposits in Europe. The necessary supply of coke, which was cut off when the Monarchy was broken up, will henceforth be furnished by Herr Stinnes, one of whose companies has acquired a large interest in the deposit. Consequently, Austria will soon be producing enough steel and iron to cover its requirements, and later be in a position to export. There is a very large machine industry, including the manufacture of locomotives, wagons, automobiles, and agricultural machines.

Owing to the shortage of coal and oil and the high prices that have prevailed for fuel during and since the war, attention has been drawn to the ample water-power available in the Alpine districts of Austria and in the Danube. Elaborate surveys and plans were already made before the war, and the total amount of available water-power is calculated at 2,250,000 h.p., of which, however, only 9 per cent. is employed. In Switzerland, which has about the same available power, 22 per cent. is in use.

Repeated endeavours have been made during the last two years to induce American, British and other foreign capitalists to assist in the exploitation of the Austrian water-power, but so far without success. The Austrian Government has now itself started work on a five years' programme for the electrification by means of water-power of 652 km. of the most western part of the State railways, in Arlberg, Tyrol, Salzburg and Carinthia, as the most remote from the coal supply, and considerable progress has been made, though the lack of coal for transport and cement-making delays the work. The expense in the depreciated crown currency appears alarming, but the cost of labour has not risen in proportion to the fall in the value of the currency, and it has been calculated that the average outlay per h.p. has fallen 62½ per cent. between 1913 and 1920. Since the crown has fallen further since October the cost now is probably still less. The expense of constructing the new locomotives will, however, be very heavy, and it is doubtful whether the electrification of the railways can really be carried through without any foreign help.

Though the programme provides for the electrification of only one-seventh of the State railways, it is estimated that when completed it will save 450,000 tons of coal and 32 locomotives, and 1,000 coal wagons now used for its transport. Before the war only 250 kilometres of the railways, mostly of narrow gauge, had been electrified, as the military authorities were always opposed to the electrification of the main lines.

Power for the numerous factories of Vienna and neighbourhood and for the electricity works of Vienna and other towns could also be obtained with advantage from water-power, particularly if coal is to remain dear and scarce in this part of Europe; but, unless foreign capital will assist, any developments on a large scale will probably have to wait until the country is more prosperous.

Whatever may be the result of the present financial negotiations for the relief of Austria, H.M. Commercial Secretary adheres to the opinion that the country sooner or later will emerge from its present troubles, and that Vienna will continue to play its leading *rôle* in South-Eastern Europe. British business men should remember that there are a large number of thoroughly sound commercial and manufacturing houses in Austria which may be inconvenienced and hampered but are not endangered by the unfavourable condition of the Austrian public finances. Lastly, it should be mentioned that this country has, in spite of all its troubles, managed successfully to preserve public order since the end of the war, and that the following of the Bolshevists is so small that they have obtained no representation in the National Assembly.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1920, has been compiled from the recently-issued official trade statistics. The figures for 1919 are added for purposes of comparison, and notes of any increases or decreases are made:—

	1919 £	1920 £	Inc. or Dec. £
Electrical cable and wire.—			
Total	272,000	417,000	+145,000
From Great Britain	182,000	394,000	+212,000
,, Japan	25,000	2,000	− 23,000
,, United States	62,000	20,000	− 42,000
Batteries, primary.—			
Total	17,000	30,000	+ 13,000
From Great Britain	2,000	6,000	+ 4,000
,, United States	14,700	18,000	+ 3,300
Batteries, secondary.—			
Total	63,000	74,000	+ 11,000
From Great Britain	11,000	26,000	+ 15,000
,, United States	52,000	47,000	− 5,000
Heating and cooking apparatus.—			
Total	24,000	41,000	+ 17,000
From Great Britain	10,000	31,000	+ 21,000
,, United States	14,000	9,000	− 5,000
Insulators, porcelain.—			
Total	4,000	7,000	+ 3,000
From Great Britain	3,700	6,000	+ 2,300
Insulators, all other.—			
Total	500	1,500	+ 1,000
From Great Britain	350	1,300	+ 950
Lamps, incandescent.—			
Total	94,000	78,000	− 16,000
From Great Britain	16,000	25,000	+ 9,000
,, Holland	28,500	21,000	− 7,500
,, United States	47,000	32,000	− 15,000
Motors.—			
Total, kW	15,000	12,000	− 3,000
£	95,000	151,000	+ 56,000
From Great Britain, kW	8,200	5,600	− 2,600
£	49,000	80,000	+ 31,000
,, United States, kW	6,770	6,000	− 770
£	45,000	68,000	+ 23,000
Transformers.—			
Total	17,000	30,000	+ 13,000
From Great Britain	4,600	10,000	+ 5,400
,, United States	12,000	20,000	+ 8,000
Electrical machinery, other.—			
Total	180,000	321,000	+141,000
From Great Britain	62,000	199,000	+137,000
,, United States	117,000	113,000	− 4,000

	1919	1920	Inc. or Dec.
Electrical material, other.—	£	£	£
Total	195,000	482,000	+287,000
From Great Britain	120,000	362,000	+242,000
,, United States	64,000	90,000	+ 26,000
,, Japan	9,000	9,000	—
,, Holland	500	5,000	+ 4,500
Cranes.—			
Total	11,000	60,000	+ 49,000
From Great Britain	8,000	47,000	+ 39,000
,, United States	3,000	13,000	+ 10,000
Elevators and lifts.—			
Total	10,000	27,000	+ 17,000
From Great Britain	7,000	24,000	+ 17,000
,, United States	3,000	3,000	—
Mining machinery.—			
Total	715,000	618,000	− 97,000
From Great Britain	303,000	419,000	+116,000
,, Sweden	1,000	—	− 1,000
,, United States	406,000	195,000	−211,000
,, Switzerland	1,000	—	− 1,000
Telegraph and telephone material.—			
Total	17,000	32,000	+ 15,000
From Great Britain	8,000	24,000	+ 16,000
,, Sweden	1,500	2,000	+ 500
,, United States	7,000	6,000	− 1,000
Tramway rails.—			
Total	4,500	21,000	+ 16,500
From Great Britain	1,500	20,500	+ 19,000
,, United States	3,000	500	− 2,500
Tramway rolling-stock.—			
Total	29,000	87,000	+ 58,000
From Great Britain	10,000	34,000	+ 24,000
,, United States	19,000	53,000	+ 34,000
Other tramway materials.—			
Total	7,500	17,000	+ 9,500
From Great Britain	1,500	3,000	+ 1,500
,, United States	—	13,000	+ 13,000
In addition to the above the following goods were imported as "Government stores":—			
Batteries, primary.—			
From Great Britain	6,000	3,500	− 2,500
,, United States	11,000	—	− 11,000
Batteries, secondary.—			
From Great Britain	1,000	21,000	+ 20,000
,, United States	—	16,000	+ 16,000
Heating and cooking apparatus.—			
From Great Britain	1,000	—	− 1,000
Insulators, porcelain.—			
From Great Britain	4,000	10,000	+ 6,000
Motors and parts.—			
From Great Britain kW	67	100	+ 33
£	1,100	1,800	+ 700
Electrical cable and wire.—			
Total	99,500	86,000	− 13,500
From Great Britain	84,000	74,000	− 10,000
,, United States	15,500	5,000	− 10,500
,, Canada	—	7,000	+ 7,000
Telegraph and telephone material.—			
Total	78,000	125,000	+ 47,000
From Great Britain	59,000	107,000	+ 48,000
,, United States	10,000	6,000	− 4,000
,, Sweden	9,000	10,000	+ 1,000
Transformers.—			
From Great Britain	137	—	− 137
Electrical machinery, other.—			
From Great Britain	1,500	24,000	+ 22,500
,, United States	400	—	− 400
Electrical material, other.—			
From Great Britain	3,000	11,000	+ 8,000

REVIEWS.

Winning the Public. By S. M. KENNEDY. New York and London: McGraw-Hill Book Co., Inc. 1920. Pp. 168; 4 plates. Price 15s. net.

The author of this work is described as the "vice-president in charge of public relations and business development" of the Southern Californian Edison Co. Most of the chapters of the book appeared serially in the *Journal of Electricity* or the *Electrical World* during the year 1920, and some have been read before meetings of people interested in the subjects dealt with.

There are fifteen chapters, and the object of all of them is the same, that of understanding the public, with the view of inducing the public to understand and trust the undertaking with which they are dealing. Patience, courtesy, cheerfulness, conciliatory bearing, co-operation, and general friendliness are urged in all cases, so that it may be clearly shown that the supplier is interested in the purchasers having a square deal first, last, and all the time.

The philosophy of the square deal is preached nowadays to an extent which might lead the cynically-minded to imagine that it had only been discovered of late years, and particularly, perhaps, since 1492. It is, however, not an exotic, nor exclusively American. It is realised even by political economists, that value must be given for value received, and that these values do not take long in mutually adjusting themselves to changed conditions. Nevertheless, it is well to bring out the desirability, not only of the square deal in itself, but of the best atmosphere in which to do business. Habits have changed in a very marked degree in the last 15 or 20 years in this respect. It is no longer considered necessary to spend considerable sums on entertaining, mainly of an alcoholic nature, in order to induce the mutually trustful frame of mind in which the transaction is best concluded. The generally friendly bearing, the willingness to give a patient hearing to what may seem to be a trivial complaint or an impracticable suggestion, the readiness to impart information on all sorts of subjects and details—in short, a desire to render service, and to give quality—these are the better things that have superseded the grosser methods formerly in vogue.

The book now before us does not seek to show how to win the public by advertising, although publicity is not neglected. It seeks instead to show how to advertise by winning the public. To some it may seem a labouring of the obvious, but as we have often remarked before, a thing does not cease to be true because it is trite. Rather does it become the more necessary to repeat the truism in a thoughtful and discerning manner, in order that we may be sure that we appreciate its full meaning, and all that its originator intended to convey. In spite of a certain amount of what the Prince of Wales graphically describes as "pi-jaw," and notwithstanding sundry liberties taken with the English language and literature, the book will serve a useful purpose, and those whose duties bring them into contact with the buying public should absorb its principles.

Dynamo and Motor Erection and Management. By A. H. AVERY, A.M.I.E.E. Pp. 152; 91 figs. London: Cassell and Co., Ltd. Price 1s. 6d. net.

Though the scope of the work is indicated on the first page by the author, as follows: "Every one who owns, or has charge of, a dynamo or motor cannot be a skilled electrician; but he can, and should, soon acquire sufficient practical acquaintance with certain technical facts and details essential to the proper operation of such machinery," even more is included in this handy little volume, *e.g.*, cable installation. The first chapter forecasts the arrangement of the matter commencing with the purchase, then the installation, cabling, and connecting up starters and control gear, transmission of power, attendance, and finally, troubles. While set forth in a simple manner, the warnings as to risk of shock (page 6) might with advantage be much more strongly impressed. It is very mild to say "220 volts is distinctly unpleasant and painful, while accidental contact with 440 volts might prove fatal." The definition of power, at the foot of page 7, is confused with that of work or energy. It would be an improvement if power and watt were defined in conjunction with one another, and then work or energy defined with watt-hour and kilowatt-hour. The definition of phase is difficult in an elementary work, but that given on page 8 is too brief to be clear. The chapter on selection of machines gives many valuable hints, and there will be those who are in sympathy with the rather complicated remark that "there are always machines on the market that it is worth paying a little to avoid the annoyance of owning." This impresses the desirability of witnessing a thorough test at the maker's works before purchasing a dynamo or motor of any considerable size. The temperature limit (page 19, at the foot) of 80 deg. F. rise above that of the room seems rather stringent compared to the figures of the British Engineering Standards Association (1917), which allow 90 deg. F. to 99 deg. F. for various parts of machines. A noticeable misprint occurs on page 22, line 4, where "pile-tips" should read "pole-tips," and another seven lines lower down, "rediates" for "radiates." On page 38 a numeral 1 being omitted gives the result of the problem worked as 9/16 S.W.G. instead of 19/16 S.W.G., marring the effect of a good example. The notes on the installation of overhead bare transmission lines for medium pressures are very good and well illustrated. The customary description of standard types of switches and fuses is given, followed by a chapter on starters, controllers, and switchboard connections. Chapter XI on drives and couplings is very clear on points to be observed and characteristics required for belt or chain driving. Then follows a chapter on the elementary principles of dynamo construction. The final Chapter XIII deals with faults and troubles of the commoner kinds and their remedies. The results of the racing away of two motors are very well shown by reproductions from two photographs of the armatures. The book should prove a useful and interesting guide to those for whom it is written.—W. N. Y. KING.

Lubricating and Allied Oils. By Elliott A. Evans, F.C.S. Pp. 128; figs. 25. London: Chapman & Hall, Ltd. Price 9s. 6d. net.

Occupying as he does the position of chief chemist to the well-known oil firm of Messrs. C. C. Wakefield & Co., Ltd., Mr. Evans's experience in all branches of his subject is beyond question.

Such a book from such an author, one might reasonably expect to be highly technical, and we were pleasantly surprised to find it couched throughout in the plainest terms. Needless to say the subject matter has been drawn from the author's experience and close association with the science of lubrication, both in the laboratory and in the workshop, and where outside information is necessarily included the name of the author and source of reference are given.

After briefly sketching the history of petroleum, oil refining, and the occurrence of fatty oils, the author deals fully with physical tests, including the electrical resistance method of determining the specific heat of oils, and with the chemical tests of transformer and other oils. The oxidation of petroleum, oleography, and the selection of lubricants are also treated succinctly, while in the final chapter, "Oils Employed," typical examples of mechanical parts and the lubricants employed therewith are given, reference being made to the most suitable oils for use with dynamos and motors, transformers and switches.

We have no hesitation in commending the book to those who, wishing to master some of the fundamental factors in the problem always facing the actual users of lubricating oils, have hitherto had to rely upon the experience of others for their facts.

Industrial Control. By F. M. Lawson. Pp. 130; figs. 19. London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net.

The six lectures originally delivered by the author at the Mappin Hall, Sheffield, after being subjected to considerable revision, are embodied in this helpful volume, the *raison d'être* of which lies in the fact that most of the industrial unrest of to-day is due to the inability of many directors of industry to direct. In other words, to their failure to recognise and to meet the needs of the laws of mutual accommodation and unity of control.

If, as the author states, the safety of the future depends upon the true records of the past, then, judging by the diagrams and charts he has selected to illustrate the results obtained at works where his system is now in use, he has well accomplished his avowed purpose of setting before those who are engaged on organisation work the true fundamental laws governing direction, whether they be applied collectively or individually to the nation, the factory, the men, or the machine.

The book is not written so that "he who runs may read"; if anything the style lacks clarity, but the man who is looking for more output and less dissatisfaction in his works will find it well worth reading.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Septon-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,957. "Arrangements of transformers and cables on electric transmission systems." A. M. Taylor. August 8th.
20,972. "Contact device for electrical telegraph transmitters." H. J. Hansen. August 8th.
20,981. "Electric cable connectors, &c." W. J. Syson Nibbs. August 8th.
20,982. "Electric incandescent lamps." E. Schattner. August 8th.
20,990. "Means for making watertight connection between cables and switch junction boxes, &c." H. V. Owen and M. J. Railing. August 8th.
20,996. "Electro-magnetic power transmission for automobiles, &c." W. McHarry. August 8th.
21,002. "Holders for electric incandescent lamps." J. W. Manley. August 8th.
21,006. "Anchor for stays of telegraph, &c., poles." T. S. Entwistle. August 8th.
21,010. "Wireless receiving systems, &c." Radio Communication Co., Ltd., and J. Scott-Taggart. August 8th.
21,017. "Electric circuit breakers." Metropolitan-Vickers Electrical Co., Ltd. August 5th. (United States, October 18th, 1920.)
21,025. "Electric switches." R. Alkan. August 8th. (France, March 24th.)
21,026. "Recording apparatus for electric current impulses." British Thomson-Houston Co., Ltd. (General Electric Co.). August 8th.
21,040. "Apparatus for regulating asynchronous machines having a commutator secondary machine." Siemens-Schuckertwerke. August 8th. (Germany, August 7th, 1920.)
21,052. "Application of natural ambient or artificial magnetisms in combination with ambient or artificial electric energy." N. Mancini. August 8th.
21,062. "Magnetos." M. E. Magrath. August 9th.
21,105. "Directional wireless apparatus." N. F. S. Hecht. August 9th.
21,108. "Electrically operated indicators." S. Webb. August 9th.
21,109. "Electrically operated indicators." S. Webb. August 9th.
21,114. "Link boxes for electrical mains." G. P. Cosway and F. Thirsfield. August 9th.
21,120. "Thermally controlled circuit interrupters." Igranic Electric Co., and (Cutler Hammer Manufacturing Co.). August 9th
21,138. "Variable electric inductances." British Thomson-Houston Co., Ltd., and R. C. Clinker. August 9th
21,140. "Control of electric motors." British Thomson-Houston Co., H. F. Farmer, and H. C. Hastings. August 9th.
21,167. "Cores for electric transformers, motors, &c." W. Langdon Davies and A. Soames. August 9th.
21,169. "High-frequency self-induction coils." E. Binard. August 9th. (Belgium, August 10th, 1920.)
21,236. "Sparking plug terminal." W. J. Atkins. August 10th.
21,252. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 10th.
21,280. "Means for regulating strength of electric currents." C. S. Agate and A. E. Hill. August 10th.
21,283. "Electric torches, &c." Ever Ready Co. (Great Britain), Ltd., and F. S. Johnson. August 10th.
21,289. "Sparking plugs." J. de La Boissiere. August 10th. (France, August 10th, 1920.)
21,305. "Starting-crank for internal-combustion engines, fitted with flywheel magneto systems." A. D. Mackellow. August 11th.
21,312. "Switches for electric vehicles." W. Rogers and Wingrove and Rogers, Ltd. August 11th.
21,333. "Induction coils for currents at radio frequency." W. R. H. Tingey. August 11th.
21,338. "Metallic articles having an electrically insulating and mechanically adhesive coating." F. Krupp Akt.-Ges. August 11th. (Germany, September 3rd, 1920.)
21,346. "Mine rescue, &c., telephone apparatus." R. L. Murray Telephone Manufacturing Co. (1920), Ltd. August 11th.
21,355. "Hydro-electric generating plant. M. Payne. August 11th
21,359. "Automatic telephone transmitters." E. S. Heurtley and Muirhead and Co., Ltd. August 11th.
21,400. "Electrical gear for operating theatre curtains, fire-proof doors, lifts, &c." A. Bibby and T. Houghton. August 12th.
21,419. "Winding, forming, &c., coils for dynamo electric machinery." B. Gill. August 12th.
21,460. "Driving mechanism for gramophones, &c., actuated by an electric motor." C. Below. August 12th.
21,463. "Wave transmission." Western Electric Co., Ltd. August 12th. (United States, August 17th, 1920.)
21,473. "Wireless signalling systems." British Thomson-Houston Co., Ltd. (General Electric Co.). August 12th.
21,474. "Control of electric motors." British Thomson-Houston Co., Ltd., H. F. Farmer and H. C. Hastings. August 12th
21,475. "Control of electric motors." British Thomson-Houston Co., Ltd., H. F. Farmer and H. C. Hastings. August 12th.
21,478. "Electric starters for internal-combustion engines." A. H. Midgley. August 12th.
21,495. "Electric controllers." Electro-mechanical Brake Co., Ltd., and M. J. Pattison. August 12th.
21,499. "Telegraphy." E. S. Heurtley. August 13th.
21,504. "Quick make-and-break switches." P. W. Davies and F. H. Reeves. August 13th.
21,507. "Electric lamps and switches therefor." O. J. Hughes. August 13th.
21,549. "Electrically-operated polishing, burnishing, and grinding apparatus, &c." A. C. Nobbs. August 13th.
21,561. "Casings for electric cut-outs, &c." W. T. Henley's Telegraph Works Co., Ltd., and W. H. Nichols. August 13th.
21,562. "Means for connecting electricity meters, &c., with supply mains." W. T. Henley's Telegraph Works Co., Ltd., and P. Rosling. August 13th.
21,574. "White electrical insulating plastic mass, and process of manufacturing same." J. F. E. Granet. August 13th.
21,665. "Apparatus for condensing mercury vapour in metal vapour rectifiers." Siemens-Schuckertwerke. (Germany, August 19th, 1920.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

13,940. "Tekmeters." A. Shtschukin. September 30th, 1916. (166,905.)

1920.

94. "Electric valve or lamp relay and intervalve transformer." G. A. Mathieu. May 3rd, 1920. (166,913.)
1,152. "Electric welding." B. Longbottom and E. Greenhalgh. January 14th, 1920. (Cognate application 21,745, 1920.) (166,914.)
1,873. "Electric switches." J. B. Tucker. October 21st, 1920. (166,918.)
8,450. "High-frequency alternator." O. Billieux. (Patent of addition not granted.) January 24th, 1918. (140,773.)
10,709. "Electric relays." W. H. Eccles. April 17th, 1920. (166,940.)
11,165. "Electro magnets." J. Neale. April 22nd, 1920. (166,951.)
11,311. "Wireless direction finding apparatus." C. K. Chandler. April 23rd, 1920. (166,958.)
11,401. "Protective devices for electric apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). April 24th, 1920. (166,968.)
11,436. "Duplex and like telegraphic systems." H. W. Sullivan. April 24th, 1920. (Cognate application 5,810, 1921.) (166,970.)
11,662. "Sparking plugs." G. Howell. April 27th, 1920. (166,985.)
11,957. "Holders or fittings for incandescent electric and like lamps." W. E. Shuttleworth. April 30th, 1920. (167,001.)
12,592. "Electric tumbler switches." M. J. Railing and W. Manchester. May 6th, 1920. (167,011.)
12,720. "Means for drying ink and discharging electricity in printing." W. H. Chapman. May 7th, 1920. (167,014.)
12,820. "Magnetos for internal combustion engines." H. Schmid and G. Fuegel. July 18th, 1917. (142,869.)
13,160. "Radiogoniometers especially suitable for use in wireless direction finding." G. M. Wright. May 12th, 1920. (167,018.)
13,417. "Electric switches." R. H. Baker and C. W. Parsons. May 15th, 1920. (167,019.)
13,928. "Electric bells or similar apparatus." A. Fisk. May 20th, 1920. (167,027.)
14,543. "Means for suspending bowls, shades, and the like, for electric and other lights." B. Richardson. May 28th, 1920. (167,032.)
14,630. "Electric burglar alarms." W. Doms. April 11th, 1918. (143,922.)
15,349. "Manufacture and production of graphite electrodes for use in electrolysis." C. L. Higgins, D. A. Pritchard, and United Alkali Co., Ltd. June 7th, 1920. (167,041.)
15,378. "Transmission of messages and signals by electrical means." Evershed & Vignoles, Ltd., and A. G. Moore. June 7th, 1920. (167,044.)
16,170. "Electric generating systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 15th, 1920. (167,049.)
17,901. "Electrode for use in depositing molten metal." W. H. Boorne. June 30th, 1920. (167,063.)
19,292. "Electrical generating units having an internal combustion engine as the prime mover." H. D. Shamberg. July 9th, 1919. (147,214.)
19,332. "Telegraphic transmitters employing thermionic generators." Ges. fur Drahtlose Telegraphie. July 15th, 1915. (147,429.)
19,345. "Method for directive wireless telegraphy with several separated antennæ." Ges. fur Drahtlose Telegraphie. June 11th, 1918. (147,442.)
19,686. "Wireless telegraph transmitters." Ges. fur Drahtlose Telegraphie. September 12th, 1918. (147,698.)
23,412. "Electric motor attachments for bath chairs, tricycles, and the like." A. C. Nobbs. August 10th, 1920. (167,092.)
24,059. "Electric direct current circuits." H. J. Warner. August 18th, 1920. (167,097.)
26,399. "Writing pad holders for telephone instruments." S. Woodward. September 13th, 1920. (167,104.)

1921.

8,476. "Screw fans." Westinghouse Electric & Manufacturing Co. April 16th, 1920. (161,934.)
11,280. "Tungsten arc lamps." Patent Treuhand Ges. fur Elektrische Gluhlampen. April 29th, 1920. (162,651.)